A Scranton Gillette Publication

OCTOBER 1961

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

UNIVERSITY MICROFILMS
313 N. 1ST. ST.
ANN ARBOR, MICH.
COPY

Metropolitan Syracuse Sewage Treatment Plant--pg. 369

UNITED STATES PATENT NO. D-190,464

250,000-gallon Waterspheroid, 130 feet to bottom.

Oak Brook, Illinois, west of Chicago and famous as a polo center, is also gaining a reputation as a pleasant location for offices and research laboratories.

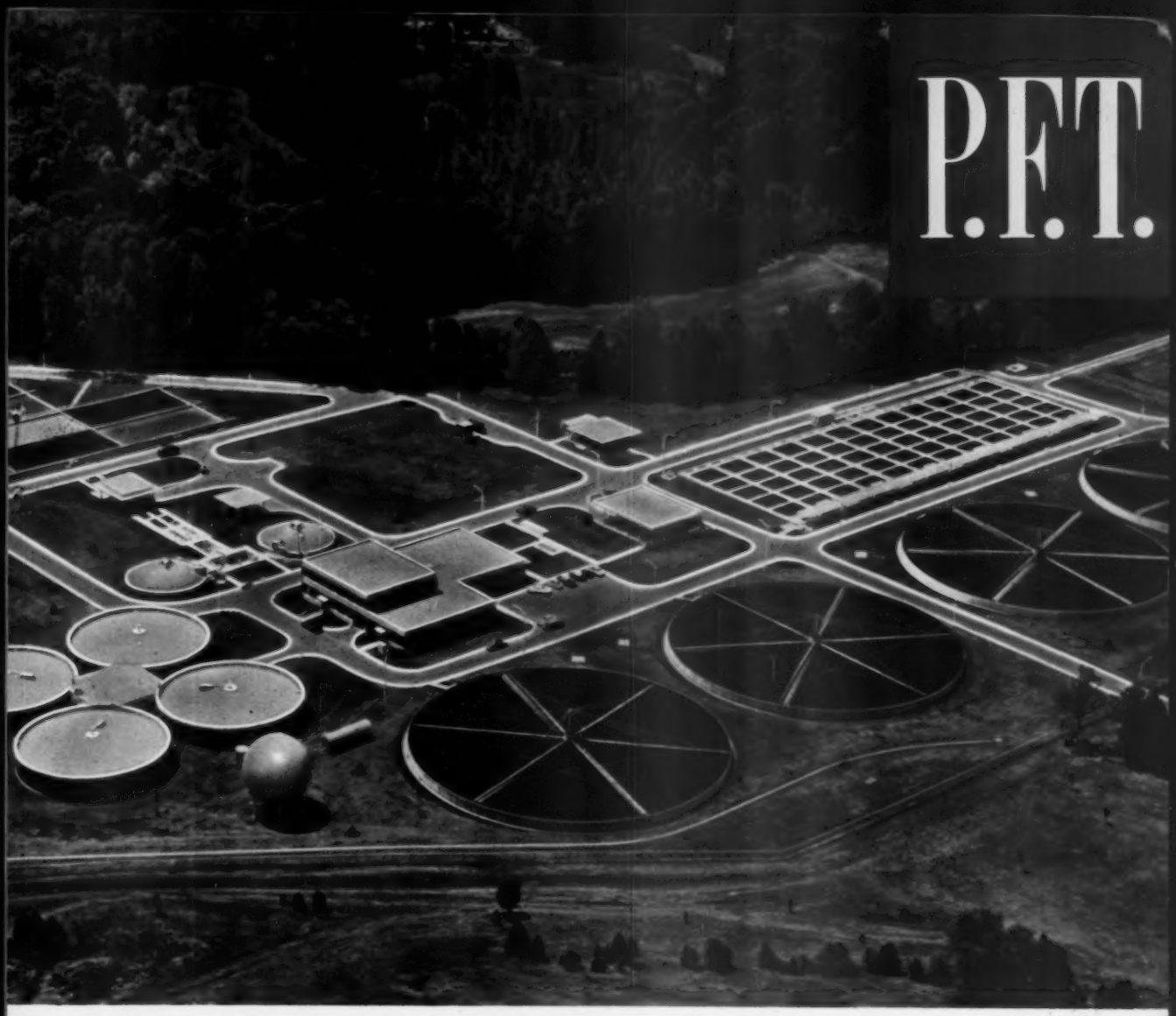
To fulfill the anticipated water pressure requirements for fire protection and general service for the area, the village recently selected two CB&I 250,000 gallon steel Waterspheroids.

This is another example where the attractive CB&I Waterspheroid,® available in capacities up to 1,000,000 gallons, or its little brother, the famous CB&I Watersphere® with capacities from 25,000 to 250,000 gallons, complements natural surroundings.

Investigate the cost benefits of having this modern water storage facility in your community. Write for Bulletin A-40. Chicago Bridge & Iron Company, 332 S. Michigan Ave., Chicago 4, Ill. Offices and subsidiaries throughout the world.

CB&I **Waterspheroid**

CB-6123



This is Winston-Salem's Waste Treatment Plant Showing P.F.T.'s 200' Rotary Distributors and P.F.T.'s 90' Floating Cover Digesters with P.F.T.-Pearth Gas Recirculation Systems.

Superior Waste Treatment at Winston-Salem . . . . Now and for Years to Come

Winston-Salem, "City of Culture, History and Industry" is a big city with big ideas; ideas that are materializing and consistently shaping the future of this southern metropolis.

In its metropolitan area there are over 280 diversified industries. Here you'll find the world's largest cigarette manufacturing plant—the world's largest men and boys' knit underwear manufacturer—the world's largest circular knit hosiery mills—and—one of the world's finest waste treatment plants.

This "bigness" spells out civic cooperation. In fact, Winston-Salem's motto is "The City Founded Upon Cooperation". Winston-Salem's growth has been planned and these plans are expanding.

All of this tremendous industrial and domestic growth demanded the ultimate in safe sanitation. Here again "the city of cooperation" took action and the construction of this waste treatment plant was the result of present and future-minded planning.

Excellently engineered this waste treatment plant places Winston-Salem among the nation's leaders in fulfilling their obligation not only to the community but its downstream neighbors as well. Winston-Salem knows that modern waste treatment equipment—P.F.T. equipment—and a modern waste treatment plant are truly a civic asset. Please turn the page for the story of P.F.T. at Winston-Salem.

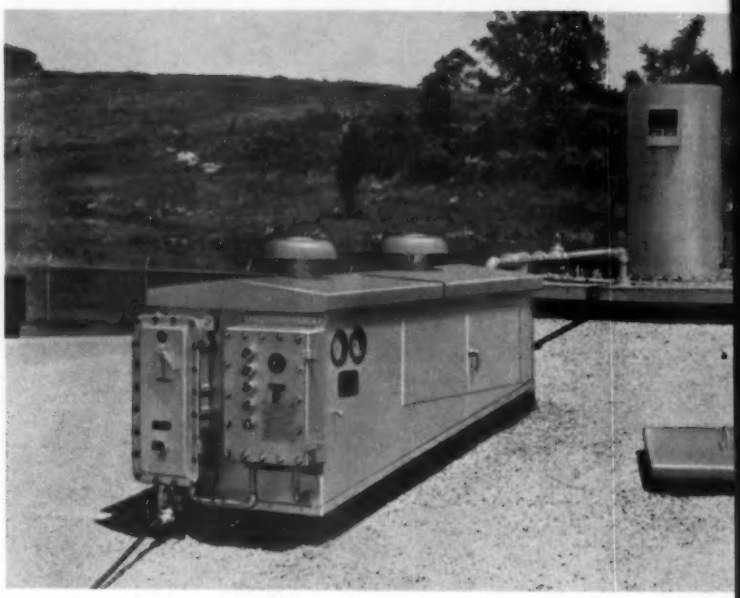
Manufacturers and designers of fine waste treatment equipment since 1893, the Pacific Flush Tank Company take pride in being a major participant in furnishing equipment for the Winston-Salem plant.

P.F.T. Rotary Distributors, 200′ in diameter, are designed to distribute 25.0 mgd of settled sewage uniformly over the entire area of each filter bed. Especially designed P.F.T. bronze forged spreader jets assure the most effective operation of these filters—these biological giants are the heart of this treatment plant.

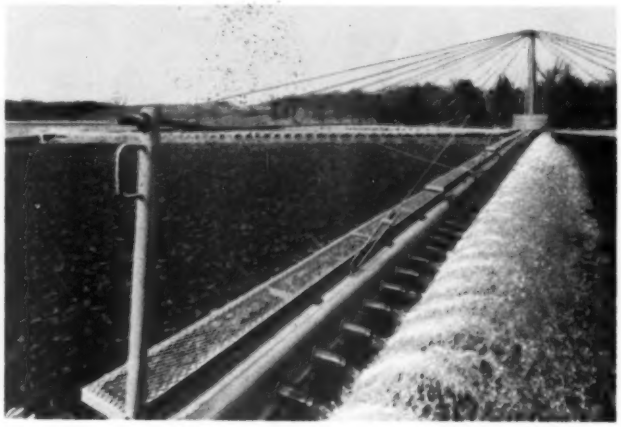
The four 90′ diameter Digesters are equipped with P.F.T. Floating Covers; three of these units have the P.F.T.-Pearth Gas Recirculation system and the fourth has provisions for the addition of the P.F.T.-Pearth equipment without taking the units out of operation.

External Heaters and Heat Exchanger units by P.F.T. allow complete accessibility in a compact unit of high thermal efficiency. With these P.F.T. #750 heaters uniform temperatures are maintained throughout the digestion system. Other P.F.T. equipment in this digestion system includes Gas Safety Equipment, Supernatant Equipment, Floating Cover Gauge Boards with High and Low Level Alarms.

This P.F.T. "Controlled Digestion System" assures Winston-Salem the most modern installation with full control of the digestion process. Controlled uniform temperatures and positive elimination of scum build-up gives complete utilization of the entire digestion volume for more effective digestion even under the highest solids loadings of the digestion tanks.



One of the three P.F.T.-Pearth Gas Recirculation Systems.



Close-up of P.F.T. Rotary Distributor arm showing P.F.T. Spreader Jets.

P.F.T.

The Winston-Salem Waste Treatment Plant was designed by the Consulting Engineering firm of Piatt & Davis and Associates of Durham, N.C.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO. 4241 RAVENSWOOD AVENUE, CHICAGO 13, ILLINOIS

PORT CHESTER, N. Y. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER • SEATTLE • SACRAMENTO • MILLBRAE, CALIF. • LOS ANGELES

WATER & SEWAGE WORKS

VOL. 108 NO. 10

OCTOBER 1961

A Scranton Gillette Publication

E. SCRANTON GILLETTE
Publisher

V. W. LANGWORTHY
Editor

C. F. GURNHAM
Consulting Editor

Contributing Editors

D. P. Beckmeyer — R. E. McKinney
J. R. Baylis — R. C. Merz
P. D. Haney — A. M. Rawn
C. E. Keefer — R. W. Simpson
J. F. Dye — W. A. Cawley

CHICAGO OFFICE: 185 N. Wabash Ave.
E. S. Gillette, Publisher
H. J. Conway, Adv. Ed.
V. W. Langworthy, Editor
C. Terrazas, Asst. Editor
E. E. Halmos, Jr., Construction Editor
W. W. Hamilton, Western Sales Mgr.
R. H. Jenkins, Sales Rep.
R. J. Rooney, Make-up Editor
W. E. Small, Jr., Copy Editor
M. McGinnis, Edit. Secy.

NEW YORK OFFICE: 155 East 44th St.
T. M. Todres, Administrative Assistant
Wm. R. Joyce, Midwestern Sales Mgr.
Terence McCoy, Eastern Sales Mgr.

239 Fourth Ave., Pittsburgh 2, Pa.
T. J. Denver, Jr., Sales Rep.

85 Post St., San Francisco 4, Calif.
Duncan A. Scott & Co.

1901 West 8th St., Los Angeles 5, California
Duncan A. Scott & Co.

1201 Forrest Lane, Birmingham 9, Ala.
Fred W. Smith, Sales Rep.

ABC ABP — IBPA

Published and Copyrighted 1961 by Scranton Publishing Co., Inc.

Contents

FEATURES

Metropolitan Syracuse Treatment Plant 369
by Samuel W. Williams, Jr.

Solar Stills 378
by Werner N. Grune, Ross B. Hughes and T. Lewis Thompson

Multiple-tube Dilution and Membrane Filter Methods 384
by W. L. Mallmann and Frank R. Peabody

Water Utility Distribution Loss. Part 3 390
by Dale E. Smelser

Cooling Water for Air Conditioning. Part 2 395
by Henry F. Munroe

Telemetering Sewage Pumping Stations 399
by George W. Welsh, Jr.

Report of London's First Effluent and Water Treatment Convention 400
by Leo Walter

Advance Friends and Be Recognized—Or! 404
by Partially Oriented

Keep 'Em Rolling 405
by C. G. Cunningham

Michigan SIWA Meets 406

Editorial—Unpublished Works 407

Bolted Pipe for an Underwater Sewer 408

DEPARTMENTS

News—Here & There 4A
Equipment News 14A
Meetings 50A
News of Suppliers 102A
New Literature 112A

COVER PHOTO—Metropolitan Syracuse Sewage Treatment Plant.—Aerial View. Photograph furnished by Dorr-Oliver, Inc., Stamford, Conn.

Water & Sewage Works is published monthly with an extra issue in August. Subscriptions including the Reference Number issue in the U.S. and Canada, 1 year $5.00; 2 years $7.50; 3 years $10.00. Other countries $1.50 per year additional. Single copies 50c except Reference Number $1.00.

MAIL SUBSCRIPTION ORDERS and CHANGES OF ADDRESS to Water & Sewage Works, 185 North Wabash Ave., Chicago 1, Illinois. Please allow four to six weeks for corrections to be effected.

E. Scranton Gillette, President; C. T. Gillette, Secretary; and H. J. Conway, Treasurer.

Water & Sewage Works, Reg. U.S. Patent Off. Published monthly by Scranton Publishing Co., Inc., at 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter at the post office at Pontiac, Ill., under Act of March 3, 1879.

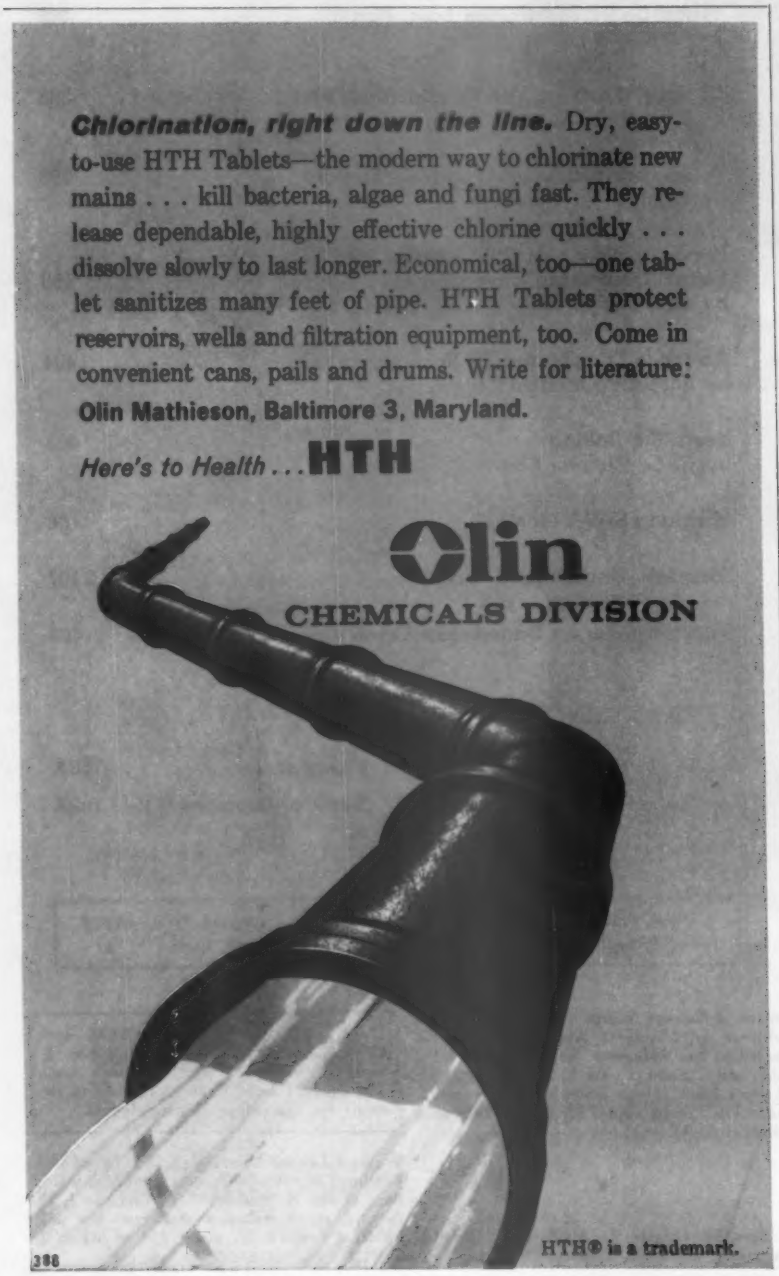
News—Here & There

Mohawk River Report No. 5 Released

"East Canada Creek Drainage Basin," the fifth report in the Mohawk River Drainage Basin Survey Series has been released by the New York State Department of Health's Water Pollution Control Board.

This report is taken from the studies of this drainage basin during 1959. The report is in connection with a public hearing held to consider proposals for the official classification of and assignment of standards of quality and purity to all surface waters in the basin.

The hearing constitutes an important phase in the development of New York State's comprehensive pollution abatement and control program under the provisions of Article 12 of the Public Health Law.


Chlorination, right down the line. Dry, easy-to-use HTH Tablets—the modern way to chlorinate new mains . . . kill bacteria, algae and fungi fast. They release dependable, highly effective chlorine quickly . . . dissolve slowly to last longer. Economical, too—one tablet sanitizes many feet of pipe. HTH Tablets protect reservoirs, wells and filtration equipment, too. Come in convenient cans, pails and drums. Write for literature: Olin Mathieson, Baltimore 3, Maryland.
Here's to Health . . . HTH
Olin
CHEMICALS DIVISION
388
HTH® is a trademark.

2,448 Ft Well Sunk in California

Tapping what is believed to be a new underground water supply, the City of Vernon, Calif., has completed the drilling of a 2,448 ft well with a potential daily output of some 2 million gallons.

The water will be taken from an aquifer, or stratum, between 1,130 and 1,260 ft below ground, as well as from aquifers above that level.

Oil drilling techniques were used with careful controls to protect one aquifer from another as drilling machinery bored through the ground and with continuing fossil studies to confirm the location of the base of fresh water.

Girand Gains Appointment In Arizona

John Girand, president of Johannessen & Girand, Inc., the oldest engineering firm in Arizona, has been appointed to the Arizona State Board to Technical Registration.

Girand, 55, will serve a three-year term on the Board.

The Board is responsible for certifying architects, engineers, geologists, land surveyors and assayers practicing in Arizona.

Waterville, Maine Water Report Issued

The Kennebec Water District, Waterville, Maine, issued its 54th annual report covering 1960.

Operating economies during the year resulted in increased net income of $10,016.26. This was accomplished despite a general wage increase for employees. The gross operating revenue increased only $1,429.16 while new service rose 160.

Last year's survey report shows the desirability of construction and replacement over the next 10 years amounting to $400,000. It also shows that the present source, and its quality, is adequate for this recommended expansion.

Eerkes Unit used in Sewer and Water Line Extension

In extending sewer and water lines to the northeast section of the Town of Oak Harbor, Wash., the Eerkes Construction Co. of Mount Vernon, Wash., used a Unit Model 1020 to dig trench. With a ¾-yd dipper, the machine is excavating sandy soil underlaid by 2 ft of hardpan.

Eerkes excavated the 4 ft wide, 9 to 12 ft deep sewer-line trench first. Then, 12 ft away, the water-line trench was dug parallel to the sewer, at an average depth of 9 ft. The completed lines ran 1¼ miles long.

Water Resources Study Under Way in Lansing, Mich.

A study for better use of water resources of the Lansing, Mich., Area has gotten under way, according to Alan R. Dean, chairman of the Tri-County Regional Planning Commission.

The object is to develop and evaluate alternative plans for use of water in the area through 1980. The 10 month study, costing an estimated $48,000, will be conducted by Battelle Memorial Institute, Columbus, Ohio.

The study will consider all aspects of water usage, including industrial, agricultural, municipal, and recreational needs.

Engineering for Men, Education for Women, Lead College Plans

Among high school seniors with plans to attend college, one in four boys planned to major in engineering and one in five girls planned to major in education, according to a study by the Census bureau.

The report of the study, entitled "Educational Status, College Plans, and Occupational Status of Farm and Nonfarm Youths: October 1959," was prepared by James D. Cowhig, Economic Research Service, U. S. Department of Agriculture, and Charles B. Nam, Bureau of the Census, U. S. Department of Commerce.

A brief report was presented in an earlier publication, but the new report presents a more detailed analysis of the survey findings.

15th Annual Puerto Rico Aqueduct and Sewer Report

An inspiring message from the new Executive Director of the Puerto Rico Aqueduct and Sewer Authority invites all peoples to mark the progress made by the 15 years of operation by the Authority.

Since 1945, the increases in service have been many. Towns with around-the-clock water service increased 1150 per cent. Mechanical sewage treatment plants have increased 2100 per cent. Water meters installed, 663 per cent. Rural communities supplied with water, 488 per cent.

The report includes many other important increases by the Authority during its short existance.

Reader Response

Gentlemen:

On reading your very interesting article in this August issue of WATER & SEWAGE WORKS, I am moved to inform you that there is more than "a single answer to two sewerage treatment problems" (page 315).

Our company, in fact, is in the business of financing sewer, water and gas facilities for new developments, as well as refinancing of existing facilities and expansion programs. The company has recently set up a division to handle builder's developments and small municipalities, as small as 300 connections.

As in all financing institutions, the character, credit, and experience of the applicant is primary, but the company actually undertakes to advise and help the developer plan properly to satisfy the larger needs of municipality and adjoining areas. American Utilities also has operations divisions which own and operate plants belonging to the company.

It might be interesting and helpful to many of your readers to know that such services are available on a national basis without any commitments to equipment manufacturers, engineers, and at the normal bank rates.

William Seltzer
American Utilities
Philadelphia, Pennsylvania

Ultrasonic Meter Cleaning

Ultrasonic cleaning systems are being employed to clean water meters more effectively, and in half the time at the Southern California Water Company.

The maintenance of meters is becoming more important because of constantly increasing cost of water and increased rates. The SCWC found and is operating a standard 10-gal-capacity ultrasonic cleaner built by General Ultrasonics Div. of Acoustica Assoc., Inc., in Los Angeles to hold down all costs.

Utilization of the ultrasonic system has nearly doubled the capacity of the utility's meter department while eliminating a hazardous acid bath method formerly used.

The system consists of a 1,000-watt generator and a 10-gal transducerized tank. The meters are cleaned in a few seconds by high frequency sound waves in the 20-kc range. These sound waves flash through an ordinary aqueous cleaning solution in the tank, resulting in a powerful scrubbing and cleaning action.

Swingley Elected to Post

Ralph L. Swingley, vice president and controller, Indianapolis Water Company, has been elected a vice president of the Indianapolis Control of the Controllers Institute of America.

Established in 1931, the Institute is a non-profit management organization of controllers and finance officers from all lines of business—banking, manufacturing, distribution, utilities, transportation, etc. The total membership exceeds 5,200.

CONTINUED ON PAGE 6A

let
VICTAULIC
cut your piping costs
Let the Victaulic Method save you money on piping costs. Whatever piping material you choose, Victaulic can join it and provide fittings. You save in material cost, in installation time, and in reduced piping maintenance cost.
CUT COSTS WITH OVER 1100 VICTAULIC ITEMS FOR BETTER AND EASIER PIPING
Standard Couplings
Lightweight Couplings
Rigid Couplings
Roust-A-Bout Couplings
Snap-Joint Couplings
Plainlock Couplings
Malleable Iron Fittings
Stainless Steel Fittings
Aluminum Fittings
Nipples and Adapters
Lined Fittings
Cast Iron Fittings
Plainlock Fittings
Vic-Groover Tools
Vic-Easy Tools
for complete information on any Victaulic product, write:
VICTAULIC
COMPANY OF AMERICA
P. O. Box 509, Elizabeth, N. J.
Plug Valves

News— Here & There

CONTINUED FROM PAGE 5A

Grid Structure Analysis Booklet Published

"The Analysis of Grid Structures," Bulletin No. 66, by B. J. Covington, professor of civil engineering, Louisiana State University, Baton Rouge, La., is being offered by that College of Engineering for $1.00.

The booklet presents a method of analysis for rectangular grid structures comprised of parallel girders and parallel transverse crossbeams.

The crossbeams are assumed to be sufficiently closely spaced such that their action can be approximated by a continuous elastic system of equivalent stiffness. Both flexural and torsional rigidities of girders and crossbeams are considered in the derivations.

Equations for the deflections and the angular rotations of the girders are derived for a load placed at any point on the structure; the bending moments of the crossbeams are given in terms of the deflections and angular rotations of the girders.

Contract Awarded for Navy Water Supply Book

The Department of the Navy has awarded a contract to Engineers Incorporated of Newark, New Jersey, and Water Services Laboratories Inc. of New York, jointly, to write a volume entitled "Maintenance and Operation of Water Supply Systems" for use at all naval stations.

The book, to be non-technical in style, is designed for use by the naval personnel who actually perform the functions. The contract calls for technical editing and creative writing of the publication.

The two firms combine knowledge and experience of every phase of water system operation and maintenance. Water Service Laboratories Inc. is a 34-year old firm of chemical engineers specializing in water treatment. Engineers Inc., since 1944, has designed and engineered hundreds of plant facilities for a variety of industries.

Two Books Available on Fire Protection

The National Fire Protection Association, Boston, has released two books dealing with fire protection.

One six page booklet deals with public water supplies for private fire protection, "Water Charges for Private Fire Protection," (NFPA No. 292M) sells for 40 cents.

The other, "Centrifugal Fire Pumps," a revised NFPA Standard, contains the minimum requirements for the design, installation and maintenance of centrifugal pumps. Copies (NFPA No. 20) are available for $1.25. This book contains 108 pages.

Both books may be purchased from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

Engineers Face Educational Problems

"The real problem facing the nation with respect to engineering manpower lies at two poles—the need to expand and stimulate graduate education, and the need to encourage and support technician education programs."

This statement was made to the Senate Education Subcommittee by Paul H. Robbins, executive director of the National Society of Professional Engineers.

Testifying on behalf of the 56,000 member organization, he said the Administration's proposed undergraduate scholarship program places the emphasis in the wrong area.

"We believe," he said, "that the primary concern of the Federal Government should be with improving the quality of our college students, not their quantity. In other words, it is our opinion that the greatest need lies in the field of postgraduate education and fellowships, rather than in undergraduate scholarships."

Robbins also pointed out the growing need for encouragement and support of educational programs for engineering technicians.

The National Society, he said, supports President Kennedy's proposal to establish a loan program to assist in the construction or renovation of classrooms, laboratories, libraries and related structures and equipment.

"Adequate up-to-date facilities and equipment are as essential teaching tools as are qualified professors and modern textbooks, particularly with respect to the education of engineers," he said.

Mrs. Cramer Presents Horse Trophy

The Willing Water Championship Walking Horse stake was presented by Mrs. John Cramer, wife of AWWA president, Lincoln, Neb.

The 1961 Charity Horse Show, held in Omaha, Neb., was sponsored by the Griffin Pipe Division, Council Bluffs, Iowa. Winner was Charles F. Brown of Joplin, Mo.

Water-Loving Plants Consuming Water Man Needs

Water-loving plants are robbing man of usable water in the Pecos Valley of New Mexico, according to John M. Kelly, assistant secretary of the Interior, on the basis of a study by the Geological Survey and the State Engineer of New Mexico.

These plants, phreatophytes, used an estimated 70,000 to 80,000 acre-feet of water a year from 1956 to 1958.

Saltcedar, saltgrass, sacaton, and mesquite occupy about 41,000 acres of bottom land in the Valley. Use of water by pasture grasslands is considered beneficial, but the remaining consumption of water by phreatophytes is considered nonbeneficial.

Much of the water now wasted by saltcedar, in particular, can be salvaged for beneficial use. This aggressive, tenacious plant can be killed by mechanical or chemical means, or by control of water levels.

The report, "An Appraisal of the Potential Ground-Water Salvage Along the Pecos River Between Acme and Artesia, New Mexico," may be consulted in offices of the State Engineer at Santa Fe and Roswell; and of the United States Geological Survey.

Cities Grow— Water Problems Do Too

Urban expansion adversely affects water resources, according to a report "Urban Growth and the Water Regimen," Geological Survey Water-Supply Paper 1591-A, released by the Department of the Interiar.

The report says in 168 metropolitan areas containing 56 percent of the Nation's population, in only 7 percent of the land area, rain falls on houses, buildings, and pavements, instead of into moisture-holding soils and small streams.

Instead of percolating into the ground, where it could recharge the water-bearing formations, water in these areas tends to run off into streams, carrying with it quantities of sediment.

The effects of these changes on our water situation are described in the report. Storm flows increase considerably. Low-lying areas may be flooded frequently because of inadequate drainage.

Stream pollution is greatly increased. Water supplies must be imported from great distances. Ground water levels are going down in areas which are heavily dependent on ground water.

Prepared by John Savini and J. C. Kammerer, the report is available from the Superintendent of Documents, Government Printing Office, for 50 cents.

New Division of Sanitation Of Public Health Service

Establishment of a new Division of Environmental Engineering and Food Protection of the Public Health Service has been announced by Surgeon General Luther L. Terry.

Headed by Wesley E. Gilbertson, the division was created to help strengthen and expand present environmental health programs, and provide assistance to other health agencies.

Functions formerly performed by the abolished Division of Engineering Services will be carried out by this Division.

These include milk, food, and shellfish sanitation programs; the water supply, food service, waste disposal and general sanitation problems of interstate carriers; metropolitan planning and development.

CONTINUED ON PAGE 8A

Pittsburgh Conference Proceedings

The proceedings of the Sanitary Engineering Conference, held at the Graduate School of Public Health, University of Pittsburgh, in October and November of 1959, have recently been compiled and mailed. Thirteen papers were presented at the conference which have direct and important application for water and sewage engineers:

"Stream Standards and Pennsylvania's Water Pollution Control Problems" was presented by Karl Mason, director of the Bureau of Environmental Health, Department of Heath, Commonwealth of Pennsylvania. He told of the Sanitary Water Board's progress in cleaning up pollution problems.

"Utilization and Availability of Water Resources," was the subject discussed by Maurice A. Goddard, secretary, Department of Forests and Waters, Commonwealth of Pennsylvania. Goddard emphasized that all men must work together to maintain supplies of good water to ensure population growth and prosperity.

"Current and Future Industrial Water Needs in Western Pennsylvania," discussed by Grant Howell, assistant to chief engineer—Steel, U.S. Steel Corp., stresses the need for increasing supply and conserving water in Western Penn.

"Considerations in the Selection of Public Water Supplies," by Herbert J. Dunsmore, chief, Bureau of Environmental Health, Alleghany County Health Dept. "The growth," he said, "of population and the expansion of industry are bringing about a deterioration of water quality through the introduction into the waterways of vast amounts of chemicals." He mentioned re-use of water as "inevitable" and suggested some control of water supply.

"Research in Sewage Treatment in the United States," was presented by Harry A. Faber, research coordinator, Engineering Resources Program, U.S. Public Health Service. He gave statistics found in water control and supply by the Federal Government.

"Applications of Some Newer Concepts in Sewage Treatment," was the topic of T. R. Haseltine, The Chester Engineers, Pittsburgh, Penn. He advocates the new Pennsylvania Manual as a guide to good engineering in the field.

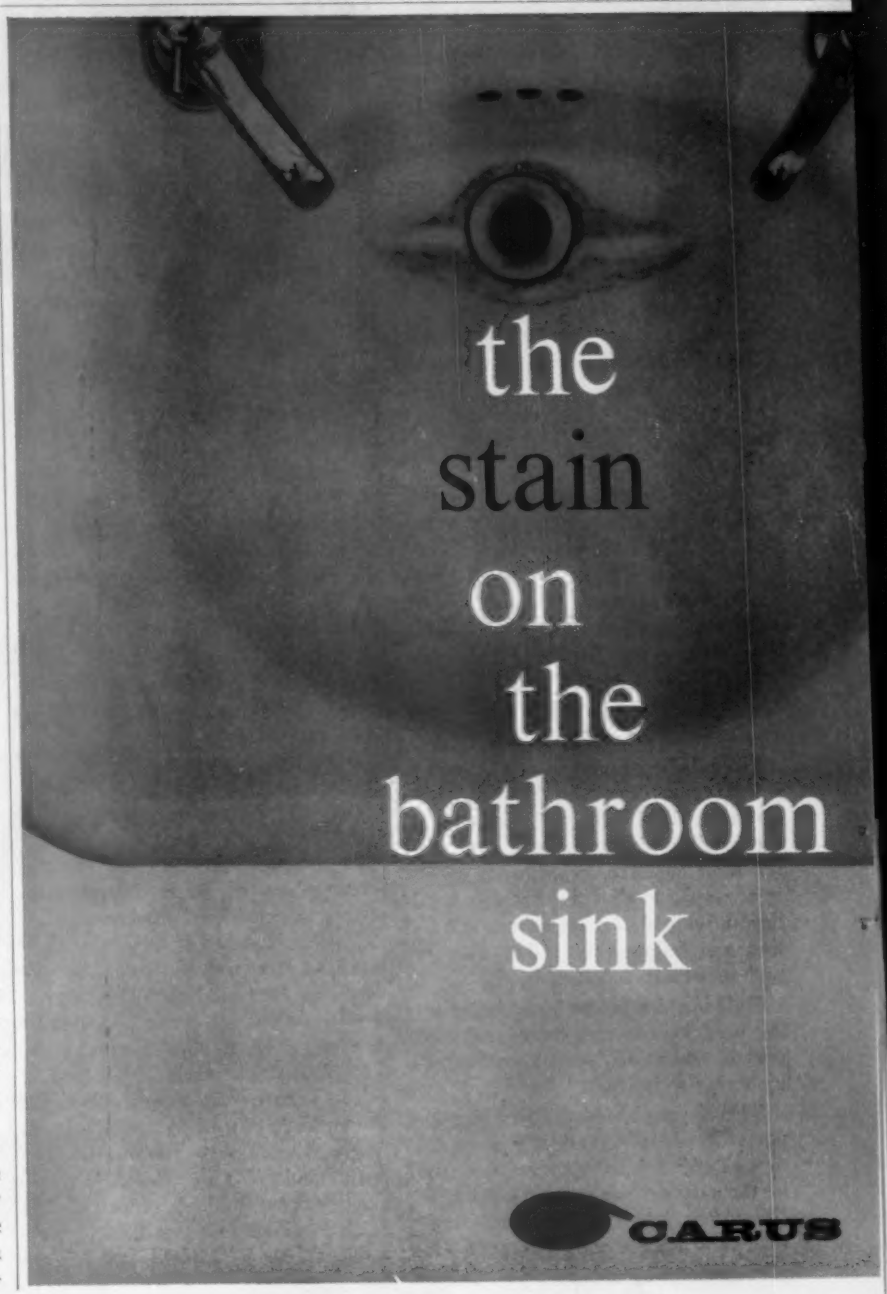
"Recent Developments in Industrial Waste Water Treatment," presented by E. G. Paulson, Hall Laboratories Division, Hagan Chemicals and Controls, Inc., develops the problem and solution of pollution abatement and its reasons.

"Water Quality Standards," discussed by M. A. Shapiro, assoc. prof., Sanitary Engineering, University of Pittsburgh. This was a development of the standards imposed upon water supplies and surface waters.

"Methods of Treating Some Industrial Wastes in Western Pennsylvania," presented by Walter Zabban, The Chester Engineers, Pittsburgh, Penn.

"Application of Chemical Coagulation to Industrial Waste treatment," was described by Bruce Gerbert; Gannett, Fleming, Cordry and Carpenter, Inc., Harrisburg, Pa.

"Application of Trickling Filters to Industrial Waste Treatment," dis-



cussed by Joseph F. Lagnese, Jr., Duncan, Lagnese and Associates.

"Application of Activated Sludge to Industrial Waste Treatment," was presented by E. Weisberg, Pantech Engineers.

"The Engineering Aspects of Financing Sewage Treatment Projects," was discussed by E. F. Twomey, Morris Knowles, Inc.

Sanitary Engineering Book

A series of articles presented at a seminar for the Boston Society of Civil Engineers on "Waste Water Treatment and Disposal," by 12 well known sanitary engineers, is now available in a paper-back book. These lectures may be purchased on a non-profit basis for $3.50 postpaid from the Boston Society of Civil Engineers, 20 Pemberton Square, Rm. 601, Boston 8, Mass.

JCUMWE Annual Report For 1961

The Joint Committee on Uniformity of Methods of Water Examination (JCUMWE) completed its fifth year March 1, 1961. The Committee, made up of men from 12 technical organizations, is engaged in the development and publication of methods of water examination. The report details panels set up for the examination of several methods.

Industrial Wastes Blamed For Most Fish Kills

More fish are reported killed by industrial wastes than other pollutants, according to a recent report by the Public Health Service.

The first annual summary report of the cooperative Federal-State fish-kill project shows that from June 1960 to January, 1961, 286 reports were received from 36 States with a total of fish killed at 6,300,000.

Agricultural poisons accounted for the second highest number of fish-kill reports, although they were in fifth place in number of fish killed.

Total river mileage affected was 1,153 miles, in addition to 51 miles of lake and bay shore lines and 1,407 acres of lakes, reservoirs and bays.

Of the 305 reports on source of kills, industrial wastes were reported in 98 instances, with a total of 5,460,000 fish killed; agricultural poisons mere reported in 81 instances, with a total of 73,000 fish killed; unknown sources were reported 51 times with a total of 190,000 fish killed; "other" sources were reported 38 times with a total of 38,000 fish killed; domestic sewage was reported 27 times with 287,000 fish killed; and mining operations reported 10 times with 250,000 fish killed.

One kill traced to industrial wastes was estimated at 5,000,000. This was in 19 miles of the Kanawha River for about two days, caused by a spill of methyl alcohol. Excluding this figure, the number of fish killed by industrial wastes is double the next named source, domestic wastes.

Polyethylene Less Serious Fire Hazard

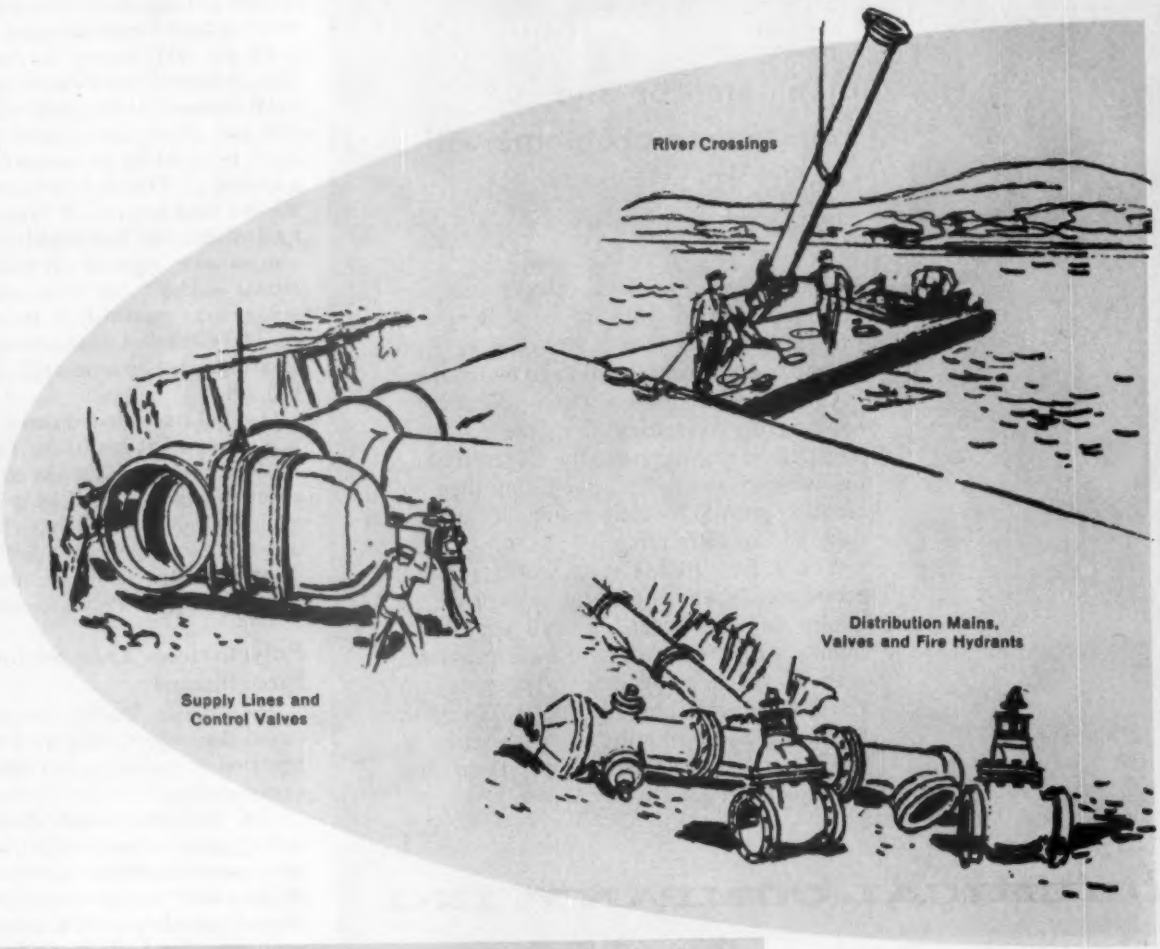
The Atomic Energy Commission claims that polyethylene used in construction is less dangerous than canvas tarpaulin.

The AEC test reveals that "The melting point is so low that hot objects coming in contact with the polyethylene melt through, rather than ignite it," according to AEC safety program specialist J. P. H. Kelly, Sr.

is a stain on your reputation
Eliminate iron and
manganese problems with
CAROX*
Potassium Permanganate
Efficient, economical CAROX Potassium Permanganate in your water system can prevent the annoying stains and clogged pipes caused by soluble iron and manganese.
CAROX goes right to work (in your present equipment), converting all of the dissolved iron and/or manganese to the corresponding insoluble oxides . . . which can then be readily removed by coagulation, sedimentation, and/or filtration.
You'll find that CAROX works rapidly, economically, and effectively, to improve the quality of your water . . . and your community's reputation. If you have problems with iron and manganese, write today to Carus Chemical Company, Inc., 1377 Eighth Street, La Salle, Illinois, for a free copy of our illustrated brochure, "CAROX Potassium Permanganate for Quality Water."
T.M.®
CHEMICAL COMPANY, INC.

CLOW

Products for every job!



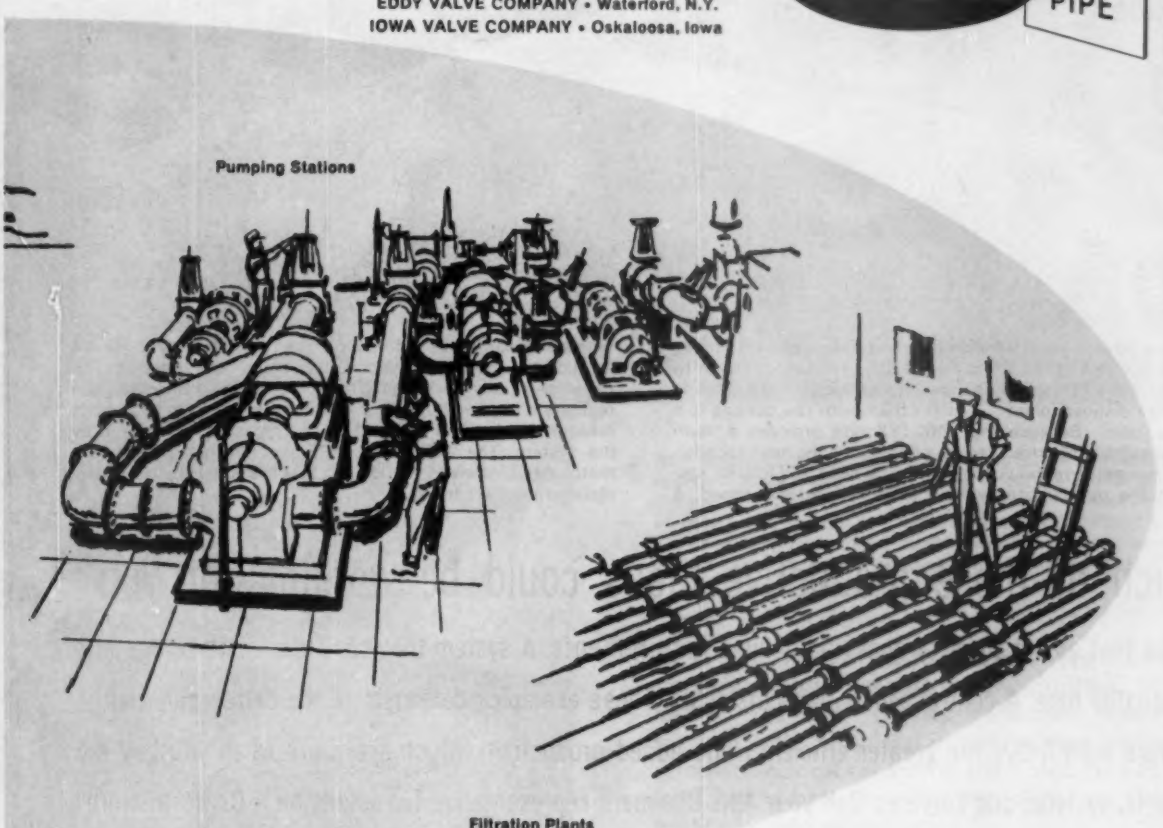
MEET EXACTING SPECIFICATIONS FOR PLANT & DISTRIBUTION SERVICE

For generations...since 1878...public officials, waterworks engineers and contractors have learned to count on CLOW products. Today, whether the need is for superior cast iron pipe, high quality hydrants, valves or fittings, or other waterworks specialties, CLOW products meet the exacting demands of plant and distribution service. CLOW facilities, experience and manufacturing skill are often invaluable in helping solve community pipe problems...in long line or extension mains, fire protection systems, filtration plants, pumping stations ...wherever distribution and control of water under pressure is involved.

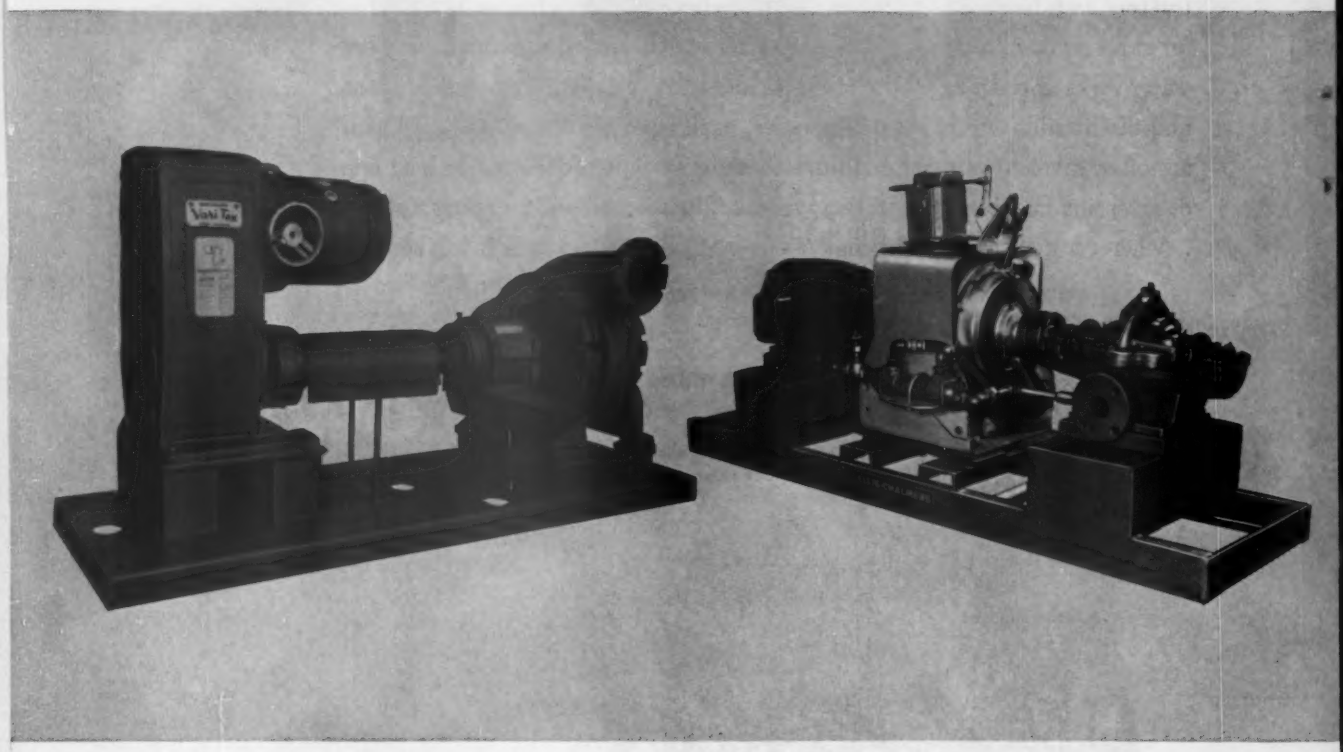
Be sure...specify time-tested CLOW materials for *your* job.

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois
subsidiaries
EDDY VALVE COMPANY • Waterford, N.Y.
IOWA VALVE COMPANY • Oskaloosa, Iowa

CLOW CAST IRON PIPE



ideas and news:



Two new ways to meet variable pumping demands with varying speed: The unit at the left is an A-C 8x6 PWG pump, driven by a 20-hp VARI-TEX speed changer. It transports dye wastes to a sewage disposal plant . . . mixes them with raw sewage to a precise ratio. Because the VARI-TEX unit provides a near-infinite number of drive speeds, it eliminates the need for additional pumps of various capacities. The ACCUPRESSURE system at the right utilizes a fluid drive for variable speed. A single unit can be used to supplement constant-speed pumps — allowing a variable capacity auxiliary to be inserted at critical steps of any operation. The ACCUPRESSURE system can regulate a clear-well level, or operate directly from a capacity measurement signal to maintain line pressure as required by the system. The ACCUPRESSURE system permits accurate matching of inflow to outflow, so that the wet-well size of any station may be reduced.

Which of these productive ideas could be working for you?

Pumps that adjust to meet changing volume requirements. A system that converts waste sludge into high-quality lime. A control center that cuts costs. These examples demonstrate the extra value that is standard with A-C... the greater efficiency and added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Industries Group, 904 South 70th Street, Milwaukee 1, Wisconsin.

A-1543

Vari-Tex, Accupressure and Track-Guide are Allis-Chalmers trademarks.

Valves "stand at attention," but will need little: Only A-C rubber-seated butterfly valves provide complete body protection. Their exclusive through-type rubber seat covers the entire inner body and extends over the flange faces. It provides an even flow pattern . . . eliminates oxidation and tuberculation. And the angle-seated vane assures positive, bubble-tight closure. The four 90-inch valves shown are to be used for pump check in a midwestern city.

New lime recovery plant turns sludge into savings: A midwestern city recently installed this A-C 150-tpd lime recovery system. Previously, purchased lime had to be discarded after it was used for water-softening. Now this 9½ x 265-ft rotary kiln — equipped with a unique arrangement of tube coolers — recovers more lime than the city consumes. The surplus produces extra revenue.

New control centers designed to cut costs: Allis-Chalmers redesigned low-voltage control centers feature TRACK-GUIDE drawout mechanism which permits individual control units to be drawn out, tilted up, or completely removed without tools. Exclusive plug-in terminal blocks save wiring time, prevent errors. Other features increase reliability and safety.

ALLIS-CHALMERS PRODUCTS: Look to Allis-Chalmers for compressors; controls; coolers; crushers; earth-moving equipment; engines; generators; industrial systems; kilns; lift trucks; motors; pumps; rectifiers; screens; electrical generation and distribution equipment; tractors; transformers; unit substations; valves; water conditioning equipment.

ALLIS-CHALMERS

EQUIPMENT IN THE NEWS

For further information on products or services please use reader service card.

Centrifugal Compressor for High Temperature Pressure Applications

A new single stage centrifugal compressor, built for high temperature and/or high pressure applications, has been introduced by this manufacturer. Designated Model HTP, the unit is designed for applications requiring working pressures from 50 to 500 psig and operating temperatures up to 800°F. Models are available with inlet capacities from 500 to 5000 cfm.

Because of its high speed characteristics and the wide variety of seals with which it can be fitted, the Model HTP is especially well suited for many new and demanding applications. Basically, a constant pressure, variable volume machine, the HTP has a wide range of stable operation.—Roots-Connersville Blower Div., Dresser Industries, Inc.

Circle No. 1001 on Reader Service Card

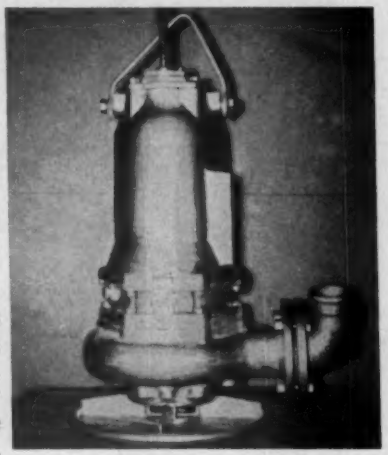
Metal-Faced Sheet Insulation

A new insulation system developed by Johns-Manville combines a highly efficient insulation material with a diamond-rib sheet aluminum facing. Called Speed-Insul Panels, the new system offers a time and labor saving method of applying sheet insulation where a weather-resistant facing is required, such as on outdoor tanks.

J-M's Speed-Insul Panels consist of Spintex insulation, factory assembled with an aluminum facing. It is supplied in sheets about 50 in. wide by 100 in. long, designed to provide a net insulation of 4 ft by 8 ft when applied with recommended overlap. Panels are fastened to metal surfaces using threaded studs welded to the surface to be insulated.—Johns-Manville.

Circle No. 1002 on Reader Service Card

Submersible Trash and Sewage Pump



A new, 220/440-volt, three-phase FLYGT CS-100 Electric Submersible Trash & Sewage Pump is now available. Equipped with 6 hp motor and 4 in. diameter hose, the portable CS-100 is ideal wherever viscous liquids, process sludges, slurries, sewage or muddy water must be pumped. Silt, clay, weeds and water containing solids up to 2 in. can be pumped without difficulty.

The CS-100 is an outstanding emergency pump. It is lightweight, easy to move, and has high capacity. Its small size makes it suitable for use in tanks, manholes, narrow wells and shafts where men are working.—Stanco Mfgs. & Sales, Inc.

Circle No. 1003 on Reader Service Card

Magnetic Drive Meters

A new ⅝ in. magnetic drive meter which operates on the nutating disc principle was recently introduced by this manufacturer.

The unit is constructed with a disc meter chamber. It is driven by a magnetic coupling designed to drive any register or meter-driven accessory on the market.

The register face has digits that are ¼ in. tall, permanent and molded integral with the wheel. A sixth number wheel has been added, extending the totalizer capacity of the meter to 10 million gallons (1 million feet).—Badger Meter Mfg. Co.

Circle No. 1004 on Reader Service Card

CONTINUED ON PAGE 18A

ALLIS-CHALMERS

The two Bascule gates at the Lake deForest Dam, Spring Valley Waterworks & Supply Co., N. Y., each 50 feet long by 5 feet high. A-C also provided 24- and 12-inch Howell-Bunger free-discharge valves, installed in the left-hand abutment, to regulate minimum flow requirements.

Bascule gates provide the extra storage you need...

save 80 to 90% of new dam costs

You can add impressive capacity and higher head to your dam by equipping it with *Bascule* gates . . . at a fraction of the cost of building a dam of equivalent capacity. *Bascule* gates are readily installed for both new and existing reservoirs, frequently in less than 9 months (compared to the 2 years or more needed for new dam construction).

By their very nature, these gates add capacity without requiring overhead structures and without increasing flood level, a dual problem not resolved with other gates. Since they discharge over the top, level regulation is facilitated . . . ice goes over the top, so they can function as ice breakers.

There's added safety too: extreme water pressure can initiate hydraulic lowering of the gate to maintain safe upstream or reservoir water levels. The result: a fail-safe installation. Or, where downstream conditions are the concern, a mechanical operator can be employed.

• • •

These unique Bascule gates are one more exclusive from Allis-Chalmers . . . proof again that A-C is your surest source of water control equipment designed to stretch investment dollars. For details, contact your local A-C representative or write to **Allis-Chalmers,** *Hydraulic Division, York, Pennsylvania.* A-1417

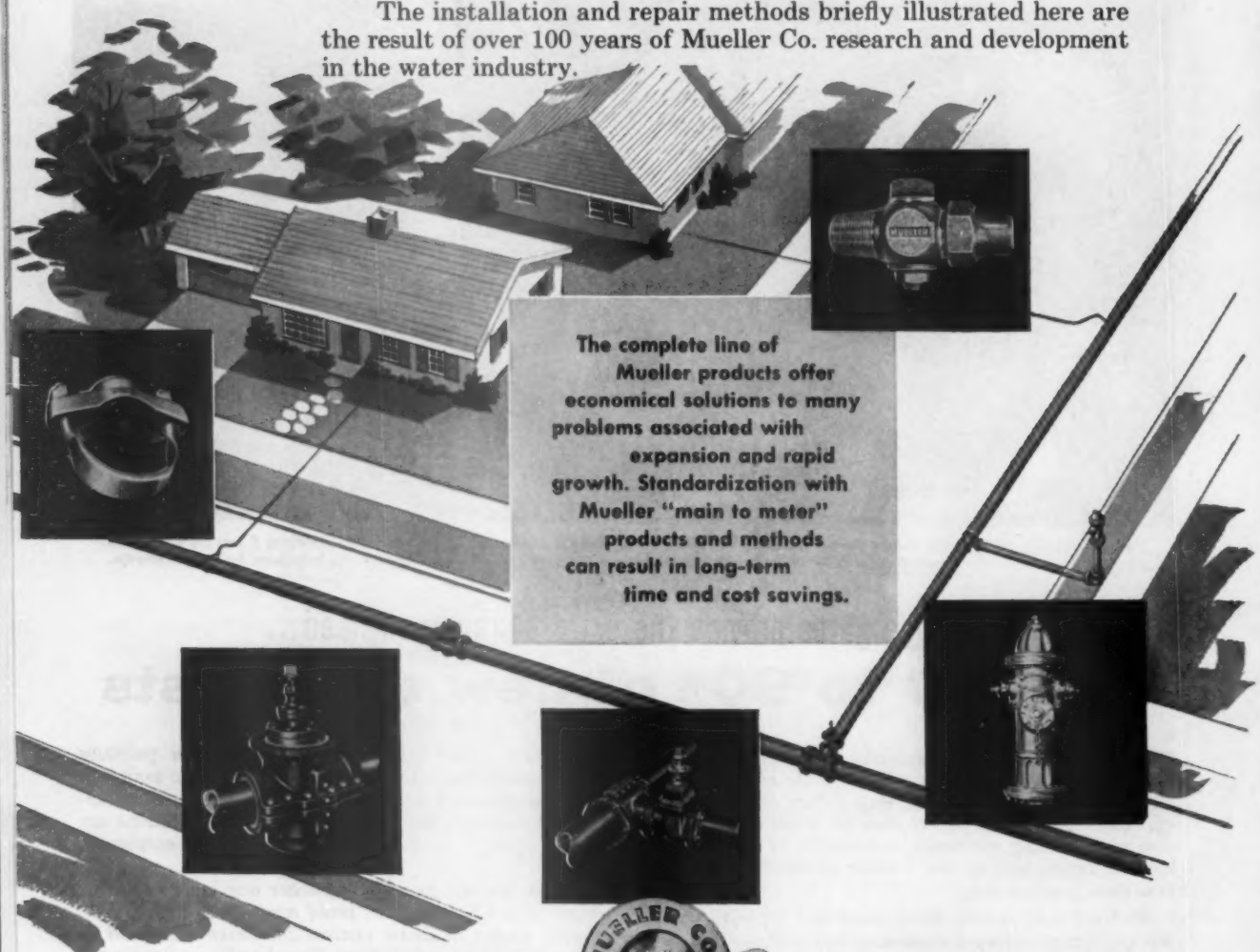
Bascule and Howell-Bunger are Allis-Chalmers trademarks.

MUELLER MACHINES
MUELLER VALVES AND FITTINGS
design matched and precisely engineered to work together

for trouble-free control of services!
economical long-life operation!
ease of installation and repair!

■ The development of the line of Mueller installation machines and methods has progressed hand-in-hand with the development of the broad line of Mueller Valves and Fittings. Every improvement in this design and work-matched line of products has proven to be beneficial to the Water Works industry in labor saving, time saving, safety, improved operation and operating dependability.

The installation and repair methods briefly illustrated here are the result of over 100 years of Mueller Co. research and development in the water industry.



The complete line of Mueller products offer economical solutions to many problems associated with expansion and rapid growth. Standardization with Mueller "main to meter" products and methods can result in long-term time and cost savings.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited; Sarnia, Ontario

6383

Making service connections with Mueller B-100 Machine and Mueller Corporation Stop.

Lower section of machine is secured to main. Boring bar assembly with drilling and tapping tool is assembled to lower section.

Main is drilled and tapped in one operation. Boring bar assembly is removed and tool is replaced by corporation stop. Machine is reassembled and corporation stop is inserted.

Machine is removed and service connection is made.

Installing Mueller Corporation Stop to thin walled pipe with Mueller E-4 Machine and Mueller Service Clamp.

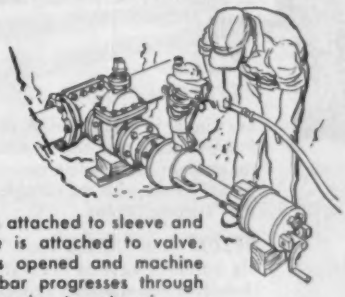
Service clamp is secured to main. Corporation stop is securely threaded into service clamp.

With stop in open position, machine is attached to stop. Tool passes through stop and drills main. Drill is retracted — stop is closed.

Machine is removed and service piping is secured to stop. Stop is opened to activate service.

Adding a lateral connection under pressure with Mueller Tapping Sleeve and Valve and Mueller CL-12 Machine.

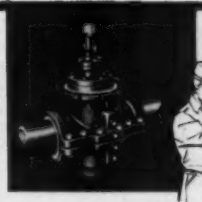
Tapping sleeve sections are secured to main to provide valve connection and to strengthen main.

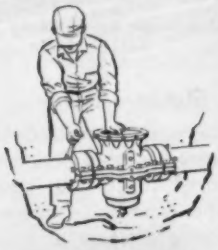


Valve is attached to sleeve and machine is attached to valve. Valve is opened and machine boring bar progresses through valve opening to cut main.

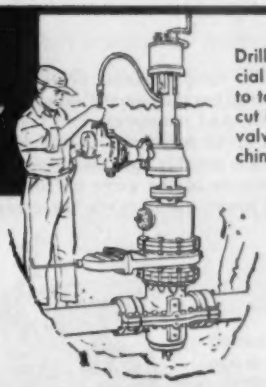
Boring bar is withdrawn through valve —valve is closed— machine is removed. Lateral piping is connected to Tapping Valve.

Adding Gate Valve Control under pressure with Mueller Inserting Valves and Mueller CL-12 Machine.





Valve sleeve halves are secured to main to provide strong valve body at point of needed control.

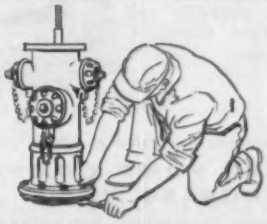


Drilling machine with special slide valve is secured to top of valve sleeve and cut is made in main. Slide valve is closed and machine removed.

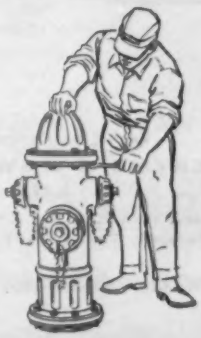
Inserting adapter is secured to slide valve. Drilling machine secured to adapter then inserts gate valve assembly through adapter into valve body.

Special safety flange has prevented breakage of barrel—special safety coupling has prevented damage to the stem. Both snap off on impact above ground with no loss of water.

Fast repair of traffic damaged Mueller Improved Fire Hydrant.



With a simple safety flange repair kit, the damaged parts are replaced and the hydrant reassembled.



The Mueller Improved Hydrant is back in service in minutes.

• For further information on products or services please use reader service card.

FOR **BIG** VOLUMES
at Low to Moderate Heads...

Verti-Line® "PROPELLER" and "MIXED-FLOW" PUMPS
ARE THE ANSWER!

If your operations call for *big* volumes of water to be lifted against low to moderate heads, here are two Layne & Bowler Pumps you should know about...

VERTI-LINE "PROPELLER" PUMPS

use a propeller similar to that on a ship, lifting the water straight up the column to the discharge head. Simple, economical and virtually clog-free, Verti-Line "Propeller" Pumps are available in standard sizes to 70,000 G.P.M....and in Single or Multi-Stage designs!

VERTI-LINE "MIXED-FLOW" PUMPS

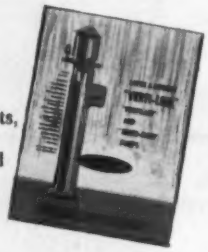
are similar in overall design to "Propeller" Pumps except that the impeller combines the straight-lift characteristics of the "Propeller" Pump with the centrifugal force of the "Turbine" Pump.

RESULT—the "Mixed-Flow" Pump lifts big volumes against even greater heads than does the straight "Propeller" design. Capacities to 75,000 G.P.M....Available in both Single and Multi-Stage designs!

WHICHEVER TYPE your particular operations call for, Layne & Bowler has the size and rating that fits *your* requirements. And remember... *all* Verti-Line Pumps are built *up* to performance—not down to competition. Yet you actually pay less for Verti-Line performance because of the extra performance, longer life, and lower maintenance these rugged pumps give!

WANT MORE FACTS?

Bulletin #1400, just off the press, gives design features, performance facts, cutaway views, etc., on Verti-Line "Propeller" and "Mixed-Flow" Pumps. Write for your free copy today!



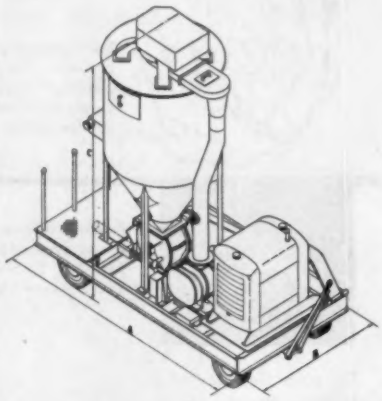
Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY
LOS ANGELES 22
New York 20, N.Y. • Chicago, Ill. • Hastings, Neb. • Monroe, La.
Farwell, Texas • Twin Falls, Idaho • Fresno, Calif.

Equipment News

CONTINUED FROM PAGE 14A

Continuous Filter-Type Portable Transfer Unit

The first continuous filter-type portable transfer unit for dense-stream pneumatic conveying of dusty materials has been announced by Fuller Co. The Airveyor® unit is available for 3 in. and 4 in. conveying lines.



The new units will handle a wide range of milled and pulverized materials, such as clay, soda ash, lime, polymers and many others.

Fuller portable Airveyor transfer units are of the combination vacuum-pressure type, with the vacuum side picking up the material, and the pressure side delivering it to the desired destination.—Fuller Co.

Circle No. 1005 on Reader Service Card

Total Flow Meter

This Manufacturer's Model 60 M Total Flow Meter has been designed to meet the need for a low cost, yet accurate and dependable instrument for measuring the flow of sewage, industrial wastes or other liquids in open channels.

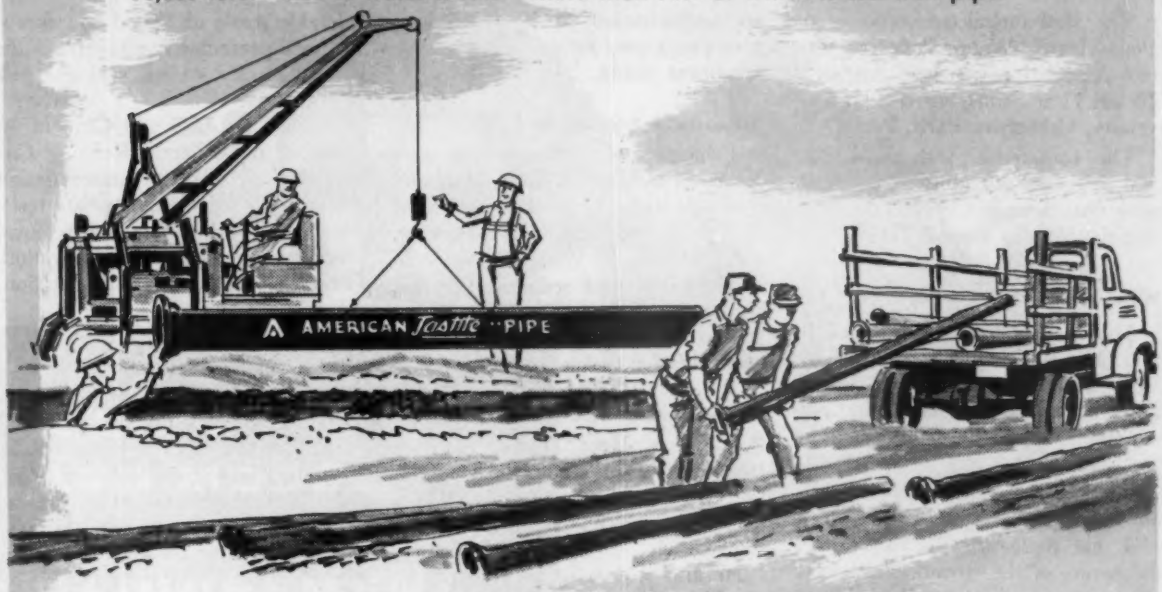
Compact and portable, mechanically operated, requiring no external power and with interchangeable cams and scales for measuring flumes and weirs, this meter is suitable for many applications.—Leupold and Stevens Instruments, Inc.

Circle No. 1006 on Reader Service Card

CONTINUED ON PAGE 26A

PIPE FACTS

The 100 largest cities in the United States, surveyed recently, have more than 95,000 total miles of water mains — more than 90% of which is cast iron pipe!



DO YOU KNOW that when larger distribution mains are needed, the smaller mains can be reclaimed for years of additional service...if they are cast iron?

In Reading, Pa., for example... seven miles of cast iron pipe was taken up and relaid – saving about $350,000. Rarely, if ever, is composition pipe taken up and re-used.

DO YOU KNOW that cast iron pipe is designed to withstand expected water hammer shocks which can burst weaker mains? In tests, it required 3,400 psi water pressure to burst 6" Class 150 AMERICAN pipe. Composition pipe of similar size and class failed at 770 psi.

DO YOU KNOW that industry requires large volumes of water...and it must be economical? For most new industrial plants, water is the most important natural resource needed. In the long run, cast iron pipe delivers water cheapest of all.

DO YOU KNOW that the AMERICAN Fastite Joint requires no caulking? Its only joint component is a dual hardness, easily-inserted, double-sealing rubber gasket. A minimum of labor and equipment is needed to install Fastite pipe...and the extra minutes saved soon total up to additional dollars saved in installation costs.

*Patented conductive gasket

AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

Pennsylvania Water Pollution Control Association Conference

The 33rd annual conference of the Pennsylvania Water Pollution Control Association was held August 9, 10 and 11 at Pennsylvania State University, University Park, Penna.

The conference, with more than 500 delegates attending, was opened with dual Sewage Operators and Industrial Wastes Round Tables.

Water, Fertilizers not Beneficial?

The first paper was presented by Dr. Clair N. Sawyer, of Metcalf and Eddy, and discussed by Dr. Albert S. Hazzard, of the Penna. Fish Commission.

Sawyer explained how fertilizers in water can become a nuisance by causing excessive aquatic growths. He said that these growths can change the nature of the stream, which may affect aquatic life adversely, and have a marked effect on the use of water for recreation.

Hazzard, noting that excessive aquatic growth can have a marked effect on fish life, discussed the paper from the standpoint of its application to Pennsylvania situations.

Thermal Pollution Discussed

Although final results of thermal pollution studies are not yet on record, Gerald E. Arnold, general superintendent of the Philadelphia Water Department, gave some interim conclusions.

He said that an advisory committee reviewed the problem and strongly stated that needless thermal pollution must be avoided, and cautioned that potential economic effects of controlling regulations must be considered.

Federal Regulation Explained

Lester M. Klashman, regional program director of the Water Supply and Pollution Division, Department of Health, Education and Welfare, explained federal regulation of and assistance to municipal sewage treatment operations.

He discussed 1961 amendments to the Water Pollution Control Act and its authorization of increased construction grants for municipal sewage treatment plants.

Sedimentation Principles Set

Principles of Sedimentation were reviewed by Gerald A. Rohlich and K. L. Murphy, of the laboratories of Hydraulic and Sanitary Engineering, the University of Wisconsin.

They described sedimentation basin design criteria and dispersion studies of rectangular and circular sedimentation tanks.

Tank Maintenance Described

Ralph A. Hoot, chief of sewage treatment plants for Philadelphia, said the shape of the tank DOES make a difference in settling activated sludge.

He also told delegates that basins should be inspected twice yearly and that non-corrodible metal shaft bearings should be used. He also indicated the need for improved reliability of shear pins on sludge collection mechanisms.

Report of Sludge Improvement

Paul Cygan, superintendent of the Erie, Penna., Sewage Treatment Plant, reported the use of a granulated emulsifier on grease. This material is mixed and pumped to the digester. The practice has reduced the amount of liquid pumped and reduced the frequency of digester steam cleaning.

Mill Water Refuse Discussed

Mill Water Clarification and Reuse was presented by John E. Barker, Armco Steel Corp., Middletown, Ohio. Barker told of his firm's project at its Butler, Penna., works.

The plant, he said, clarifies and treats a variable flow of from 3,000 to 11,000 gallons per minute of steel waste water. The treatment renders water suitable for return to the main mill water system, to be used throughout the plant.

Oil Treatment Presented

The petroleum industry places considerable stress on "good housekeeping" and preventative measures in the control of oily wastes, said one pair of engineers.

William A. Hall and Clement A. Vath, of the Atlantic Refining Co., said that oil waste separator design should be based on appropriate tests. They described alternate removal processes, including; centrifugation, filtration, distillation and flotation.

Color and Chemical Treatment

A trio of industrial engineers described a complex problem of treatment of wastes from the manufacture of printing inks at the Ridgway Color and Chemical Co., Ridgway, Penna.

Roy F. Weston, William D. Sitman and Harry H. Curtin, of the Roy F. Weston, Inc., consulting engineering firm, Newton Square, Penna., described the treatment program and the physical facilities at the ink company.

Civil Defense Role Explained

John Yenchko, Kappe Associates, Inc., Pittsburgh, new association president, presided over the last session during which Dr. R. E. Fuhrman discussed the role of the sewage plant operator in civil defense.

Also included was an explantion of waste water flow measurement in open and closed channels given by Blair Hipple, Fischer and Porter Co.

Contact-Stabilization Described

A new method of sewage treatment, contact-stabilization, was described by the man who designed the plant and the man who operates it.

The plant, at York, Penna., was designed by A. A. Estrada, Albright & Friel, Inc., and run by Guenter Spohr, superintendent of the York Sewage Treatment Works.

The York process was the first such variation in the operation of an activated sludge plant in Pennsyvania. Both men hold high hopes for the success, and economy, of the system.

AMERICAN *Water Meters*

A SIZE AND MODEL TO MEET EVERY REQUIREMENT

Just one QUALITY... *the Finest!*

Smallest American Meter, 5/8" x 1/2" . . . largest, the 6" Heavy Duty Meter. Solid Casing and Frost Bottom types . . . capacities from 20 GPM to 1000 GPM — to meet every water requirement. Add to this large range in sizes, the most complete design flexibility of any meter and you have the reason why so many water utilities specify AMERICAN.

Every AMERICAN Meter, regardless of SIZE, has the basic, built-in features of unmatched construction simplicity, unequalled measuring accuracy, and the widest range of parts interchangeability.

Every AMERICAN Meter is a measuring instrument of the highest quality, built to last longer, with the least maintenance; to provide greater earnings and better public relations.

Subsidiary of AMERICAN METER COMPANY

For complete details, write for Bulletin 33

BUFFALO METER COMPANY, INC.

Dept. WS, 2917 Main Street • Buffalo 14, N. Y.

300 North Gilbert Avenue • Fullerton, Calif.

Sales representatives throughout the nation

PIPE THAT SHOULDERS A HEAVY LOAD WITHOUT SHOWING ITS AGE

Recently installed in a town in Illinois, this cast iron pipe water supply system now serves a large industrial area.

Besides the internal pressure of supplying the heavy daily demand, there is a heavy load overhead, too. The industrial area is a packaging and distribution center. Large numbers of fully loaded rail cars and trucks come and go every day.

As far as the cast iron pipe is concerned, this is all in a day's work.

Cast iron pipe shoulders heavy loads—interior and exterior—year after year; performs efficiently for a century or more.

And it always delivers a full flow of water.

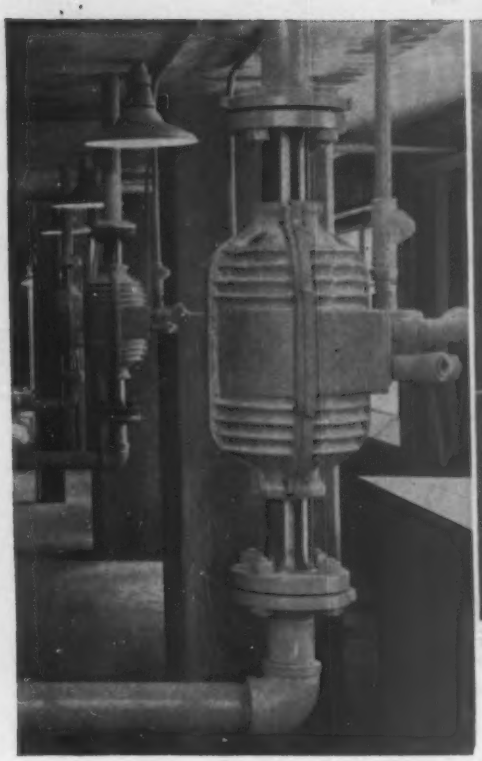
Advertising campaign from Cast Iron Pipe Research Association shoulders a heavy load, too!

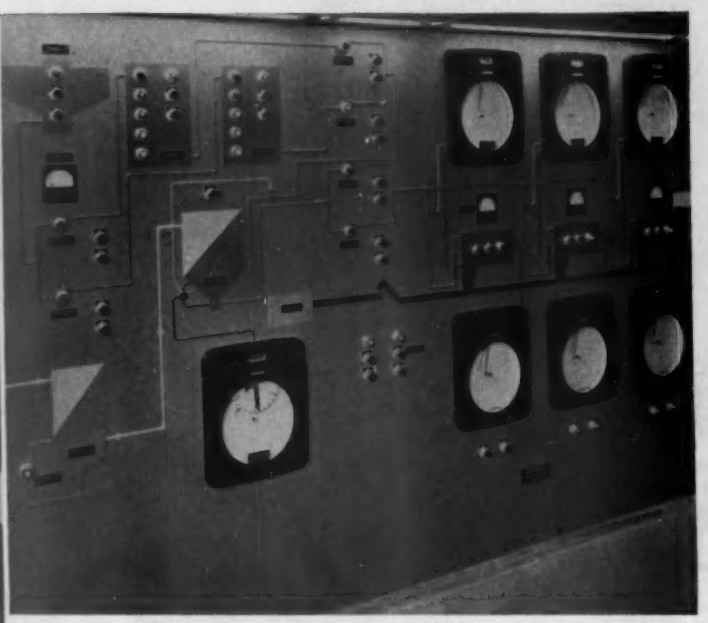
For years the Cast Iron Pipe Research Association has attacked the water problem nationally; now, in addition, it is undertaking a new campaign to combat this crisis on a local level. Car cards, speeches, radio spots, newspaper ads, mailing pieces—everything will be included. If your town's problem is apathy or a growing water shortage, we may be able to help. For complete details, write to the Cast Iron Pipe Research Association today!

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

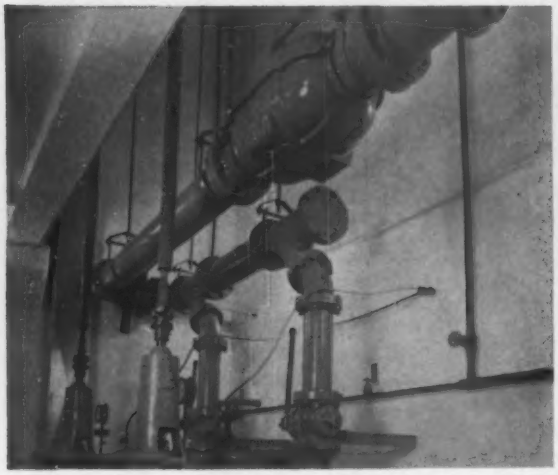
CAST IRON PIPE
THE MARK OF THE 100-YEAR PIPE

Foxboro Magnetic Flow problems for

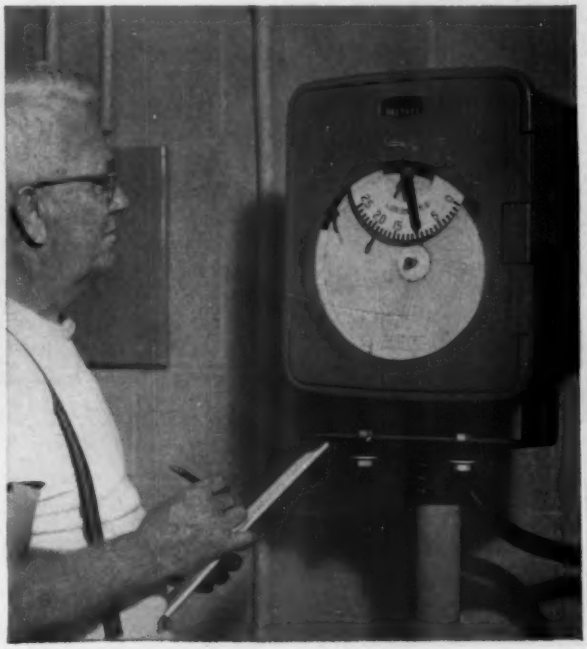




DAYTON, OHIO Three Foxboro Magnetic Flow Meters measure flow of sludge to centrifuges at Dayton's Lime Recalcining Plant. Designed around these meters, plant actually recovers up to 20% more lime than originally added to water. Graphic control panel in Feed End Building operates entire plant.



NEWPORT, R. I. At Newport, R. I. influent at the main sewage plant comes from both the town and a nearby Navy base. Determining how much of the total should be billed to the Navy is the job of the Foxboro Magnetic Meter and Foxboro Dynalog Recorder shown above.



Meters eliminate line restriction these municipal utilities

Introduced six years ago, the Foxboro Magnetic Flow Meter has proved its superiority for measuring water, sewage, sludge and other treatment plant flows.

Foxboro Magnetic Flow Meters have no flow restrictions of any type. No taps to get plugged or frozen, no seals or purges, no moving parts of any type. Measurement is made by electrodes flush-mounted in meter wall — then transmitted by electric cable to a Foxboro Dynalog* electronic recorder. Accuracy is ±1%.

Foxboro Magnetic Flow Meters have solved some of the toughest municipal measurement problems. Ask your Foxboro field engineer to show how it can help with yours. Or write for Bulletin 20-14. The Foxboro Company, 8910 Neponset Avenue, Foxboro, Massachusetts.

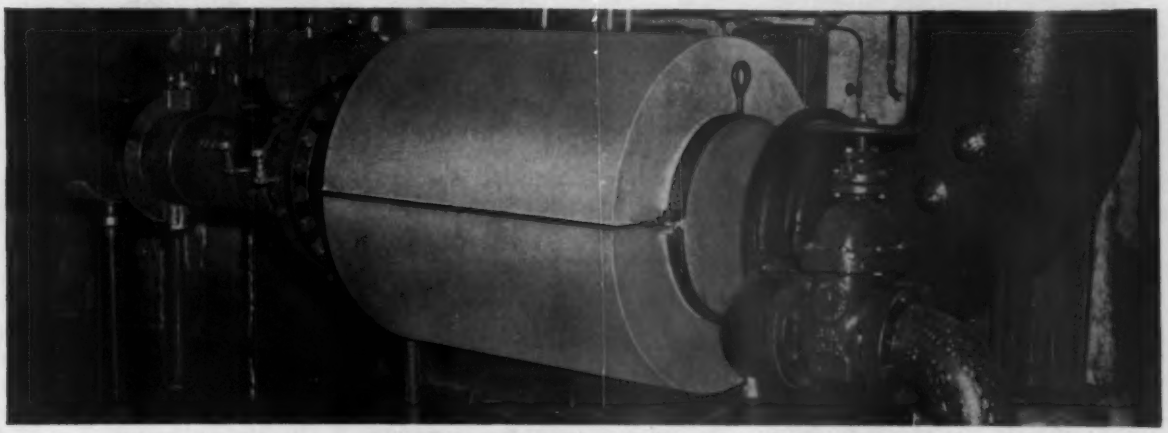
Reg. U. S. Pat. Off.

Partial List of Progressive Communities Using Foxboro Magnetic Flow Meters

Benton Harbor, Michigan	— raw sewage
Hayward, Calif.	— water
Pittsburgh, Pa. (Allegheny County Sanitary Authority)	— raw sewage
Covington, Ohio	— return activated sludge
Medfield, Mass.	— water
Orange County, Calif.	— sewage
Warren Township, Michigan	— raw sewage and sludge
Bloomfield Township, Michigan	— water
Seattle, Washington (Lake City Sewage Plant)	— sludge
Milwaukee, Wisconsin	— sludge
Piqua, Ohio	— sludge
Arkansas City, Kansas	— sewage
Sidney, Ohio	— return activated sludge
Frazer, Michigan	— raw sewage

Meter sizes on these installations range from 3 inches to 6 feet.

FARMERS BRANCH, TEXAS Eight-inch Magnetic Flow Meter at a sewage lift station. Meter was installed below ground level, right next to elbow and valve, without affecting its measurement accuracy.



CHICAGO, ILLINOIS This 20" Foxboro Magnetic Flow Meter was installed in the South District Filtration Plant in April, 1956. Because it has no line restrictions, plant officials knew the meter would add no more pressure drop than an equivalent length of pipe. Note how it was installed directly downstream from an elbow.

FOXBORO

REG. U.S. PAT. OFF.

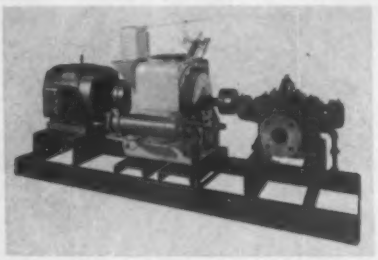
Equipment News

CONTINUED FROM PAGE 18A

"Accupressure" System

The "Accupressure" system for maintaining constant water pressure within 1½ to 2 percent limit despite varying demand, was recently announced by this manufacturer.

The new system consists of a centrifugal pump (Type S or KS), a constant speed motor and a fluid drive and control. It is available in 3 to 200-hp range, 50 to 5000 gpm, primarily for use in buildings where large volume and constant pressure are required but where demand varies.



Control consists of a pressure sensing device that, in turn, governs depth of a scoop tube on the fluid drive. This action raises or lowers speed of the output shaft to the pump. The compact "Accupressure" unit is designed for new and modernization applications, and replaces roof tanks or basement pressure tanks. Maintenance is limited to normal bearing and packing inspection.—Allis-Chalmers Mfg. Co.

Circle No. 1007 on Reader Service Card

Emulsifiers for Ortho-Dicholorobenzene

Emulsifiable ortho-dicholorobenzene is widely used to eliminate odors from garbage dumps; sewage, leather, rendering and other plants; land-fill waste disposal projects, etc. It is also used as an engine cleaner, a tar remover and for similar purposes. All of these uses depend upon the use of low concentrations in water. Clarco Emulsifiers 11 and 12 are low-cost, liquid concentrates specifically formulated to make orthodicholorobenzene self-emulsifiable in water.

From 15 to 20 percent by weight of the Clarco Emulsifier is mixed with ortho-dichlorobenzene. No heating is needed. The resulting clear solution will instantaneously form an opaque, milky emulsion when poured into water. The emulsion is stable and shows no solvent separation in 24 hours, even when the ortho-dicholorobenzene concentration is as low as 1 percent.—The Clarkson Laboratories, Inc.

Circle No. 1008 on Reader Service Card

2-Stage Centrifugal Pumps

The addition of two new sizes more than double the capacity range of Goulds Model 3305-06 2-stage centrifugal pump line. Now available in sizes 6x8-17 and 8x10-17, these new units provide capacities up to 3000 gpm for heads up to 550 ft at 1750 rpm. Complete information including performance curves, material specifications, interchangeability charts and dimensions is given in Bulletin 722.6 —Goulds Pumps, Inc.

Circle No. 1009 on Reader Service Card

New Manhole Riser Cushion

The Manhole Riser Cushion is a new product which combines steel and rubber to end noise and reduce wear on worn manhole covers and frames. Costly manhole repairs are eliminated. The manhole riser cushion becomes a permanent operating part of the manhole casting, absorbing and dissipating road shock from heavy traffic.

The riser cushion extends the life of the worn manhole cover and frame by acting as an absorbent rubber cushion, thus reducing premature replacement. It is available in round, square or rectangular shapes.—Utilities Supply Div., Central States Industrial Supply Co.

Circle No. 1010 on Reader Service Card

Continuous Turbidity Measurements in Water Supply Systems

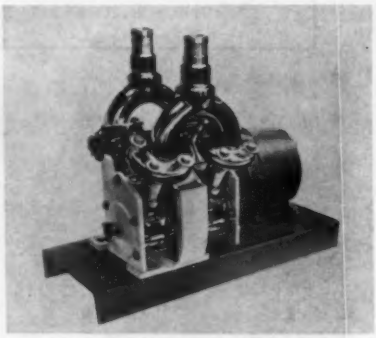
In order to meet the increasing need for improving the drinking water supply, permanent control of the raw water by continuous measurement of turbidity caused by suspended contaminants has become a necessity. So far, turbidity measurements have been made largely by visual methods. These, aside from being somewhat inaccurate, are time consuming and lack continuity.

A far superior arrangement for making these measurements with maximum accuracy on an uninterrupted basis makes use of a photoelectric measuring system which determines either light transmission (or absorption) or the intensity of the scattered light (Tyndall effect). The Sigrist Photometer, offered by this manufacturer, can be employed for the measurement of turbidities at all levels of intensity, as well as for automatic flow control. The photometer can be installed ahead of a filter system for checking the raw water or behind the filter. The measurements made by the instrument can be continuously recorded.—Brinkmann Instruments, Inc.

Circle No. 1011 on Reader Service Card

Sanitary Pump with No Glands, Shaft Seals, Gaskets

A duplex pump extending the capacity of its line of sanitary "flex-i-liner" pumps to 40 gpm has been developed by this manufacturer. Like other "flex-i-liner" pumps, the Saniflex sanitary pump has no shaft seals, packing glands, nor stuffing boxes and has no rotating parts in contact with the fluid being pumped.



Pumping is accomplished by rotor on an eccentric shaft, turning inside an inexpensive replaceable flexible liner. This creates a progressive squeegee action on fluid trapped between the synthetic liner and the stainless steel body block. The pump is self-priming, operates wet or dry and can handle slurries and viscous materials. Duplex Saniflex pumps have capacities from 30 to 40 gpm.—Vanton Pump & Equipment Corp.

Circle No. 1012 on Reader Service Card

CONTINUED ON PAGE 108A

drink up...

AND GIVE THE TOWN A GOOD NAME!

AQUA NUCHAR
ACTIVATED CARBON
for taste and odor control

Do people judge the administration of your town by the water you serve them?

To be sure the impression you make is always favorable, depend upon AQUA NUCHAR and daily threshold odor tests. Daily testing tells you exactly how much or how little AQUA NUCHAR you need to do an effective control job surely . . . *and economically.*

Extremely low concentrations disperse billions of porous particles of AQUA NUCHAR throughout the water. Taste-and-odor-causing substances are quickly entrapped and removed by adsorption. And the cost averages only a few cents a day.

Our research staff is always available to help you solve your taste-and-odor-control problems.

West Virginia Pulp and Paper

INDUSTRIAL CHEMICAL SALES DIVISION

230 Park Ave., New York 17 · Philadelphia National Bank Bldg., Philadelphia 7 · 35 E. Wacker Dr., Chicago 1 · 2775 S. Moreland Blvd., Cleveland 20

"All you're gonna do is
scare the fish cousin Ferd...
you ain't goin' to find
no leaks in them joints"

U.S. cast iron **PIPE** FOR WATER, SEWERAGE AND

not a leak in a lakeful!

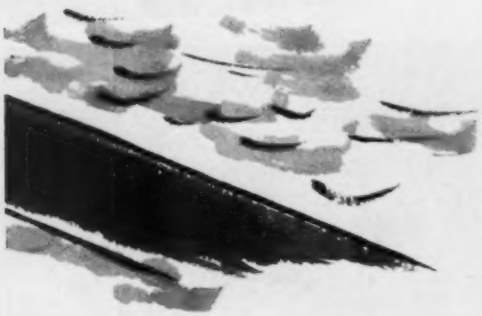
The joints on USIFLEX® Boltless Flexible Joint Pipe are bottle-tight. Joint is made up with a moderate thrust to move ball past self-sealing gasket in socket. Rugged retainer ring locks joint against pull-out during installation and in service. And no wrenches, bolts or nuts to worry about.

Underwater jobs are never easy. But Usiflex simplicity, speed and ease of handling make them almost a pleasure. Want to cut costs, save time and labor next time you have a tough underwater job? Call or write today for illustrated technical brochure on Usiflex.

U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A Wholly Integrated Producer from Mines and Blast Furnaces to Finished Pipe.

Makers of TYTON JOINT® Pipe.



USIFLEX®
BOLTLESS FLEXIBLE JOINT* PIPE

*U. S. Patent No. 2,564,938

INDUSTRIAL SERVICE CAST IRON

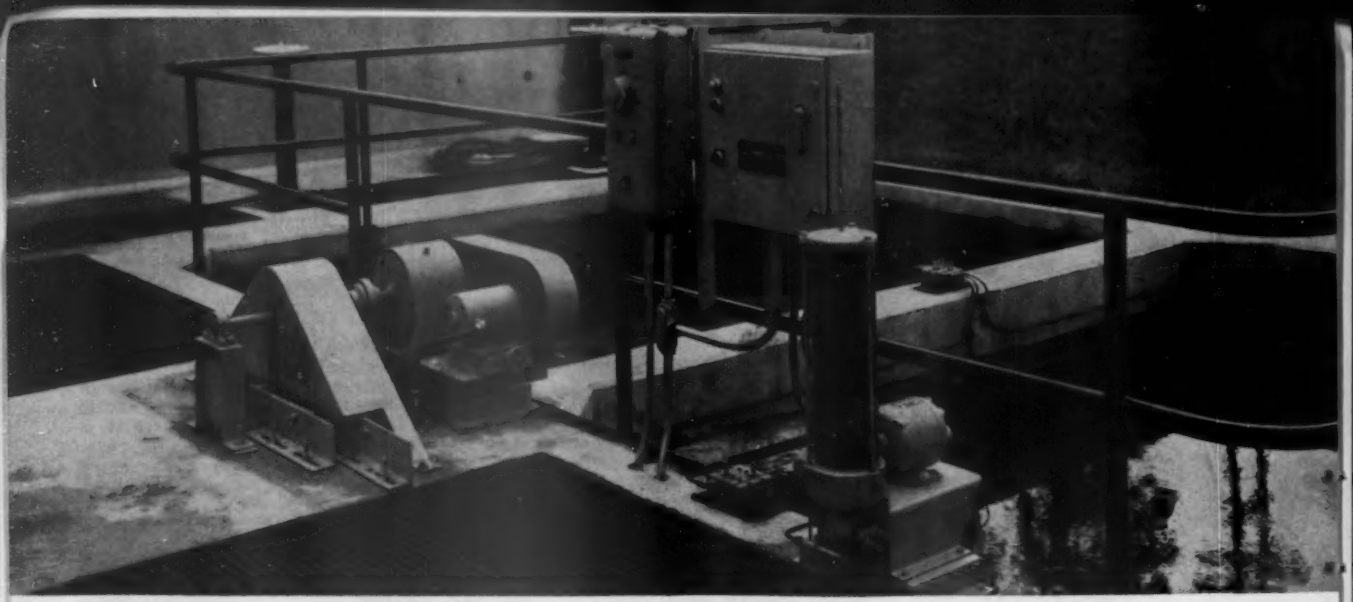
1 Insert the gasket in its seat in the socket. Forming gasket loop helps initial stage of seating. Release of loop allows gasket to spring into the gasket seat where it is securely held.

2 Apply special Usiflex lubricant to the ball and inside surface of seated gasket in socket. After lubrication, ball is ready to be pushed into socket.

3 Ball has been socketed. Retainer ring lugs have been lined up with recesses in bell and retainer ring is ready to be moved into the bell and rotated.

4 After insertion and rotation of retainer ring in bell, the lugs on retainer ring are in back of and in register with internal flange segments in bell. Lead lock is partially inserted into recess between the bell and retainer ring.

5 Lead lock completely inserted in recess is being caulked in place by hammer blows on a wide caulking iron.



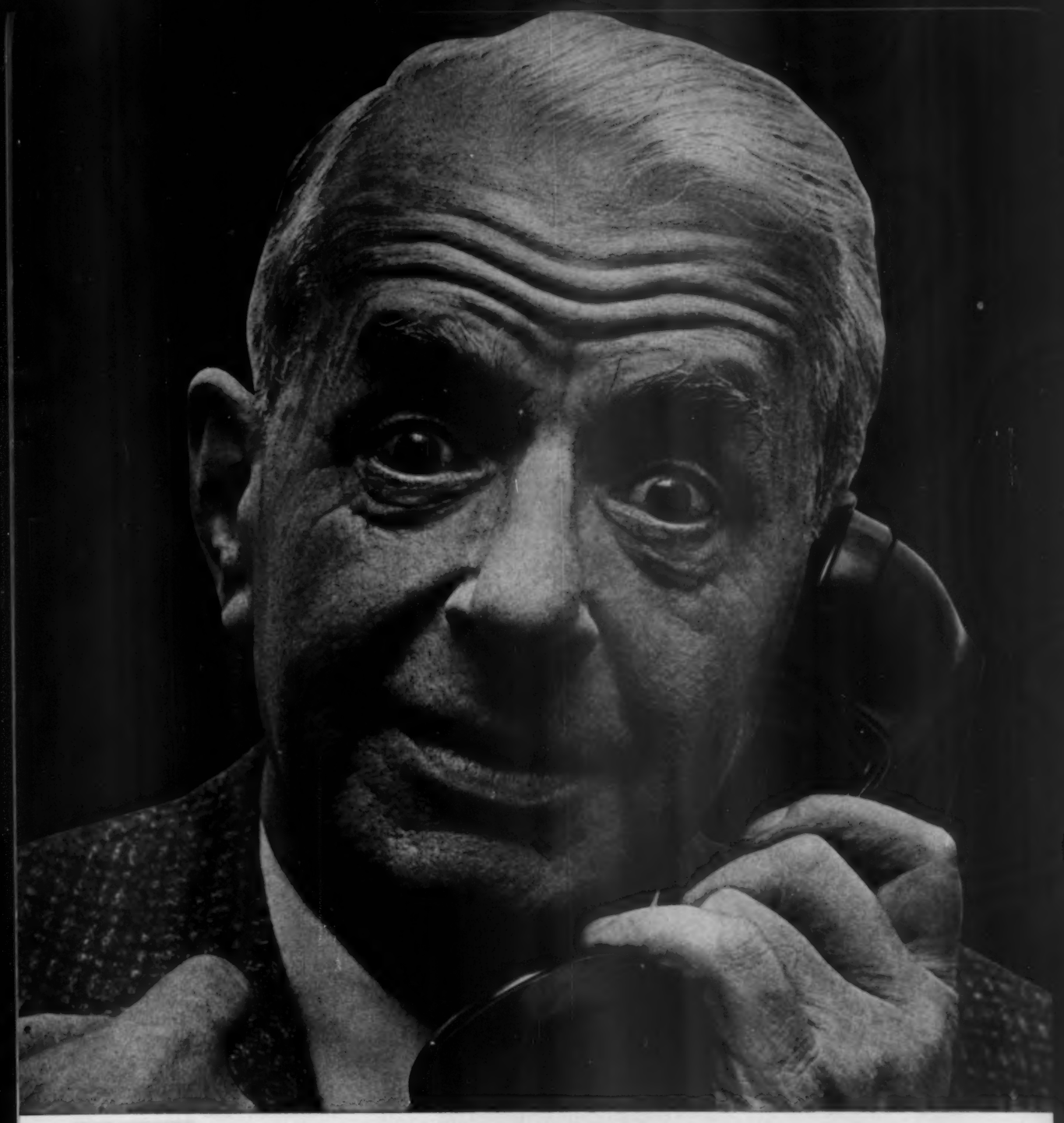
JEFFREY WATER TREATMENT SYSTEM SERVES NEW KENTUCKY HOMES

To provide for the growing needs of Winchester, Kentucky (pop. 10,149), J. Stephen Watkins, Consulting Engineers, called in Jeffrey sanitation engineers...specified Jeffrey flocculator and settling tank equipment. The new installation shown below incorporates Jeffrey's exclusive Floctrol® process to provide rapid flocculation with minimum chemical dosage. The compact settling chamber equipment pictured above features an automatic lubrication system that periodically introduces grease to underwater bearings. Jeffrey's Sanitary Engineering Division offers complete technical assistance in designing and equipping water, sewage and industrial waste treatment installations. For further information, write today for Catalog 952.

The Jeffrey Manufacturing Company, 996 North Fourth Street, Columbus 16, Ohio.

If it's conveyed, processed or mined, it's a job for Jeffrey

JEFFREY



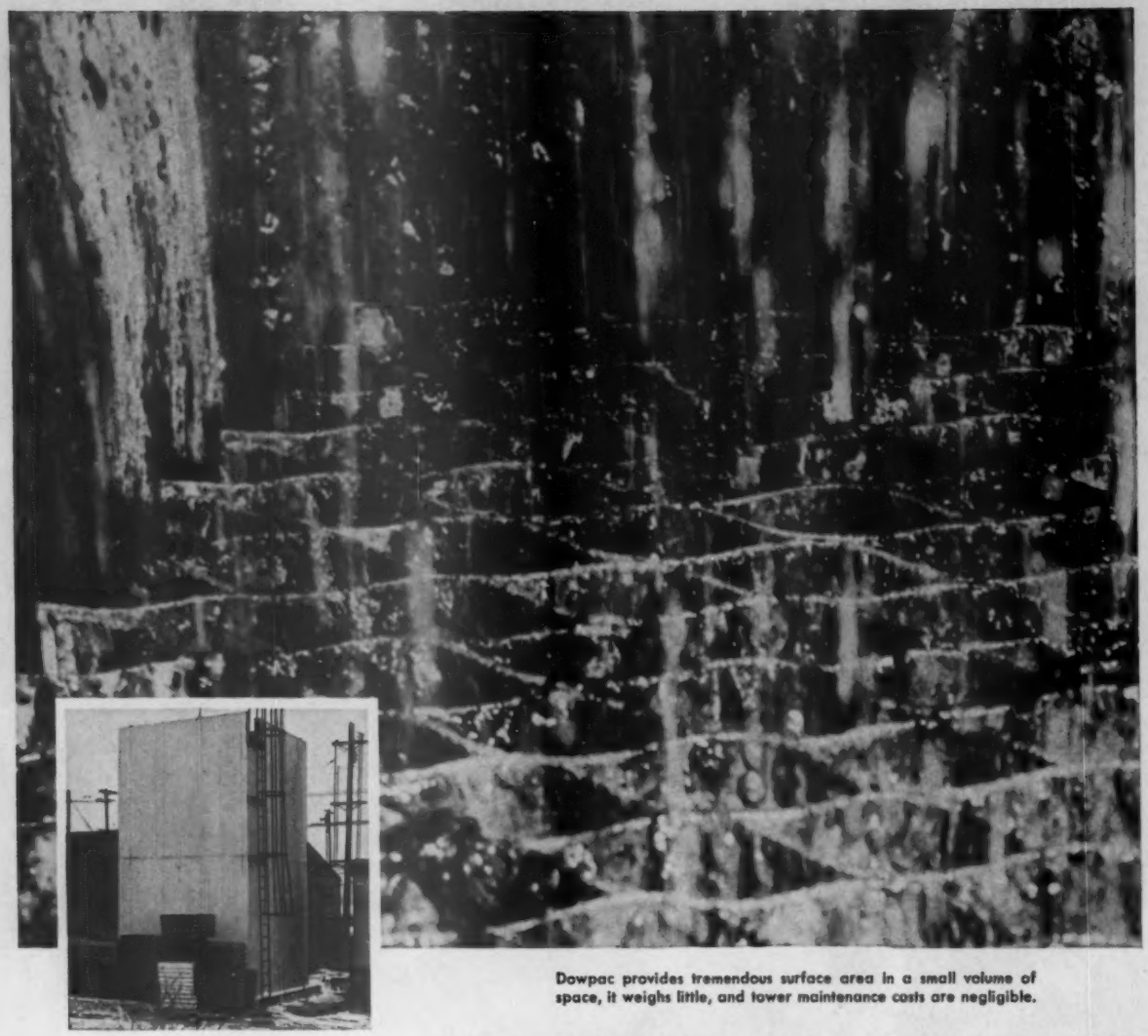
"He's calling me the idiot!"

"Of all the nerve! I oughta remind His Honor that *he* hired the guy who wrote up the pump specs. No experience clause . . . and who's low bidder? Some outfit that builds *bilge pumps!* The Mayor should hear those things howl and vibrate! Sure they meet rated capacity, but all the bearings are so hot it smells like we're barbecuing grease! Next time I'll make darn sure we get that experience clause *in*."

Comprehensive *experience* in pumps — an important benefit that's yours when you deal with Allis-Chalmers. Industrial Equipment Division, **Allis-Chalmers,** Milwaukee 1, Wisconsin. A-1501

ALLIS-CHALMERS — 92 YEARS OF PUMP EXPERIENCE

Allis-Chalmers has a pump-building history going back over 90 years. In 1888, we developed the largest centrifugal pumps of that time . . . and they are still operating. Through a program of sound, gradual development, Allis-Chalmers pump designs are improved regularly with tested ideas . . . no idea goes into production for our customers until it has been proved sound in tests.



Dowpac provides tremendous surface area in a small volume of space, it weighs little, and tower maintenance costs are negligible.

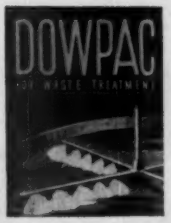
NEW DOWPAC MEDIA TREAT SEWAGE AND WASTE FAST IN LITTLE SPACE

. . . D.I.S. offers low-cost pilot plant to prove system for your waste conditions!

Contoured plastic sheets of Dowpac® packing media interlock (above) to form a continuous, lightweight grid for low-cost treatment of water-borne wastes. Because of light weight and high operating efficiency, a waste treatment system using Dowpac requires much less land area for construction than other waste systems, while operating at higher waste concentrations.

Cost advantages—Economical first cost . . . low maintenance and operating costs . . . conserves expensive land. **Operating advantages**—large area for bacterial growth . . . efficient aeration . . . freedom from plugging. **Total advantages**—a D.I.S. waste treatment system using Dowpac costs you less to install and operate and treats more waste faster, at higher concentrations, than other kinds of systems.

Pilot plants employing Dowpac can be rented or purchased, and D.I.S. engineers will help customers develop the most effective use of Dowpac for their particular waste conditions. Dow Industrial Service works with industries of every kind, anywhere in the U. S. Further, D.I.S. offers consulting laboratory service for water and waste treatment, backed by technical resources of THE DOW CHEMICAL COMPANY. For further information, write or call DOW INDUSTRIAL SERVICE, 20575 Center Ridge Road, Cleveland 16, O., Dept. WSW10.



FREE BOOKLET on low-cost, high efficiency waste treatment using Dowpac. Send for a copy today.

DOW

Dowpac is a trademark for packing media—not pilot plants

DOW INDUSTRIAL SERVICE • Division of The Dow Chemical Company

HOLDS TIGHT AGAINST SEVERE VIBRATION

W-K-M's Non-Lubricated Eccentric Plug Valve

This valve is located close to a piston pump handling a heavy and abrasive sewage sludge. Since it was installed more than a year ago in this modern sewage disposal plant, it has made a record of perfect performance — *no effects from severe vibration, no leaks, no maintenance, no repairs.*

Severe vibration was destructive to all previous valves which — frequently and at random — worked open or closed causing almost perpetual stem and line leakage. Constant attention and maintenance were required.

W-K-M's Eccentric Plug Valve is ideal where such severe conditions are involved. Its unique design allows it to maintain its open or closed position regardless of vibration or other shocks. The resilient elastomer bonded to the plug efficiently resists the abrasive action of sludges or other solid-bearing liquids.

Write for full information, P. O. Box 2117, Houston, Texas.

When So Much Depends on a Valve

. . . *Specify* W-K-M

W-K-M
DIVISION

ACF INDUSTRIES

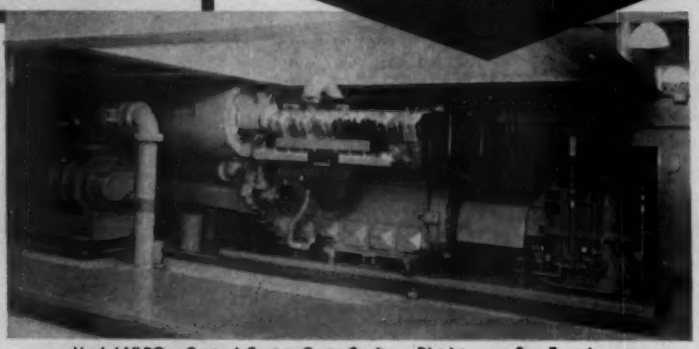
WAUKESHA POWER for MUNICIPAL PLANTS

NATURAL OR SEWAGE GAS • GASOLINE • DIESEL • LP GAS

10-1235 HP

ENGINES

Waukesha engines for water and sewage applications are available for gas or gasoline fuels or as normal or turbocharged Diesels. From this complete line select exactly the *right* engine. Materials, design, and operating characteristics are the result of over fifty years' experience in building fine engines. For honest, reliable, profitable operation, you cannot buy better engine power.



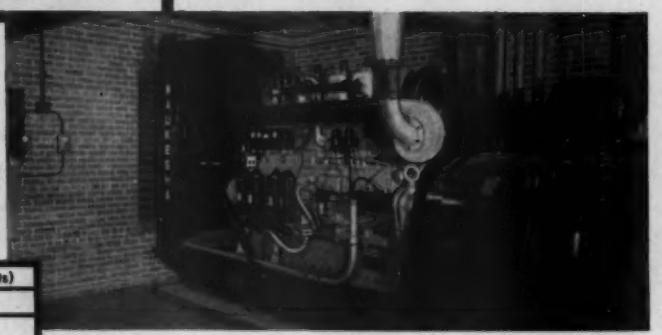
Model VLRO—Central Contra Costa Sanitary District, near San Francisco.

NATURAL GAS-SEWAGE GAS LP GAS-GASOLINE					DIESEL FUEL ENGINES				
Model	B & S	Cyl.	Displ.	Max. HP @ RPM	Model	B & S	Cyl.	Displ.	Max. HP @ RPM
135-GZ	4⅛x5	6	451	135@2400	148-DK	5¼x6	6	779	200@2100
140-GZ	4⅛x5½	6	554	191@2400	148-DKBS	5¼x6	6	779	280@2100
145-GZ	5⅛x6	6	817	240@2400	WAKD	6¼x6½	6	1197	258@1800
WAKC	6¼x6½	6	1197	309@1800	WAKDS	6¼x6½	6	1197	400@1800
NKR	7 x8¼	6	1905	343@1200	NKD	7 x8¼	6	1905	297@1200
LROR	8½x8½	6	2894	515@1200	NKDS	7 x8¼	6	1905	390@1200
LRZ	9½x8½	6	3520	590@1200	LRDC	8½x8½	6	2894	415@1200
VLRO	8½x8½	12	5788	980@1200	LRDCS	8½x8½	6	2894	695@1200
					VLRD	8½x8½	12	5788	905@1200
					VLRDS	8½x8½	12	5788	1235@1200

Ratings shown are maximum. Continuous ratings and speeds are in Waukesha Chart 1079. *Models here* are most frequently used for municipal service. Waukesha's approximately 30 gas, gasoline and Diesel models range from 10 to over 1200 hp. Turbocharged Diesels indicated by letter "S" in table.

ENGINATORS®

Waukesha Enginators are accurately balanced engine and generator combinations that perform dependably in all applications requiring a smooth, steady flow of power for continuous, intermittent and stand-by duty. 50 to 800 KW capacities—gas, gasoline, normal or turbocharged Diesel operation.



350 KW (Model LRDCSU) Waukesha Diesel Enginator.

Approximate ratings—consult Waukesha Motor Co. for ratings applicable to your service.

MUNICIPAL ENGINATORS—CONTINUOUS DUTY RATINGS (Kilowatts)

DIESEL ENGINATOR SERIES					GAS ENGINATOR SERIES				
MODEL	60-Cycle RPM				MODEL	60-Cycle RPM			
	720	900	1200	1800		720	900	1200	1800
135-DK	NA	NA	NA 50*	60 75*	135-GZ	NA	NA	35	50
148-DK	NA	50 NA*	65 85*	100 150*	140-GZ	NA	NA	45	65
					145-GZ	NA	NA	70	100
WAKD	NA	75 120*	100 150*	125 200*†	WAKC	NA	85	110	150†
NKD	100 125*	125 150*	150 200*†	NA	NKR	106	130	160†	NA
LRD	150 200*	185 275*	250 350*†	NA	LROR	160	200	250†	NA
					LRZ	200	250	300†	NA
VLRD	325 400*	400 500*	500 675*†	NA	VLRO	325	400	500†	NA

NA = NOT AVAILABLE. Ratings based on standard conditions—29.92" Hg. Barometer and 60° F. Air Temperature. Ratings are maximum KW for continuous duty at sea level at speeds indicated. Gas models rated using 1000 BTU Natural Gas. For Diesel models, upper KW ratings are for naturally aspirated models, and lower ratings marked * are for turbocharged models. Ratings are for radiator cooled fan units. Higher ratings permissible with heat exchanger cooling. Higher ratings available for intermittent and stand-by service. † Consult Waukesha Motor Company stating specific applications details.

WAUKESHA MOTOR COMPANY

WAUKESHA, WISCONSIN

NEW YORK • TULSA • HUNTINGTON PARK, CALIF.

Factories: Waukesha, Wisconsin; Clinton, Iowa; Houston, Texas 516-R

LAYING PIPE UNDER WATER was the tough assignment of Lloyd Kispert & Son, contractors of Green Bay, Wisconsin, at the town of Preble, Wisconsin.

Below the water table... water-tight joints

Lloyd Kispert & Son recently laid 3611 feet of 12-inch K&M Asbestos-Cement Sewer Pipe within a few hundred feet of Green Bay. The water table was so high that the pipe was laid under water. Nevertheless, all joints had to be infiltration-tight. On the next page, Mr. Kispert, in his own words, tells how he solved this problem.

You can dig flatter grades for K&M Asbestos-Cement Sewer Pipe because its bore remains smooth and clean.

Water, snow, mud, and rain can't hold up the installation of K&M Asbestos-Cement Sewer Pipe.

"K&M ASBESTOS-CEMENT GRAVITY SEWER PIPE GAVE US PERMANENTLY TIGHT JOINTS IN WET GOING!"

"This was an extremely rough job. But, with K&M Pipe, we got tight joints in wet going. The K&M FLUID-TITE® Coupling connected easily, even under water. The men just had to lubricate the tapered end of the pipe and slide it into the coupling. We didn't need any heavyweight coupling pullers. Our men had an easy time handling the pipe because of its light weight. We are very satisfied with K&M Pipe and will use it again."

Mr. Lloyd Kispert

You could lay K&M Asbestos-Cement Sewer Pipe at the bottom of a 58′ deep lake, and it would be infiltration-tight.

The smooth bore of this modern pipe remains clean, permanently. The friction coefficient is low. You can plan fewer lift stations and flatter grades.

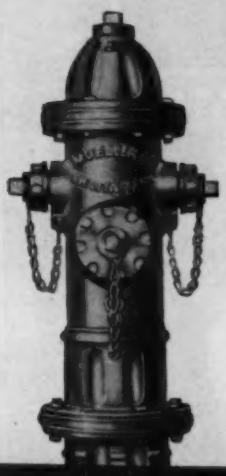
K-M

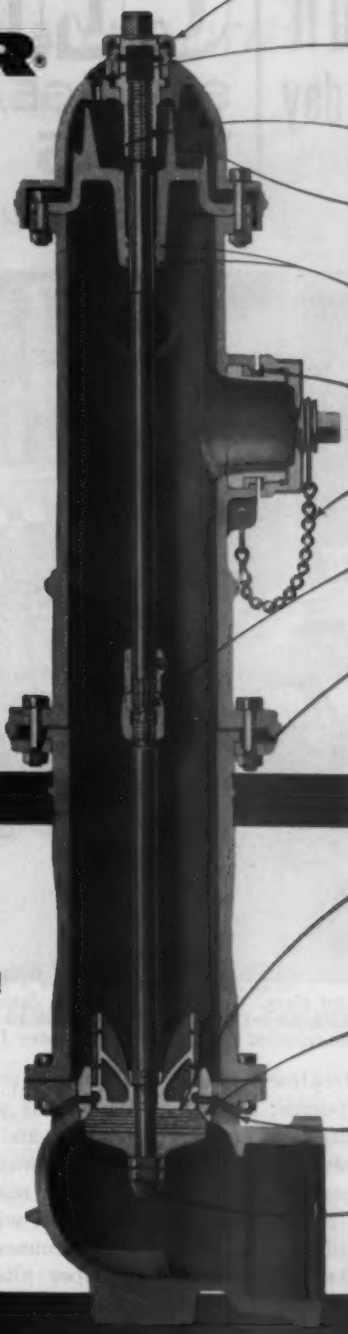
Keasbey & Mattison at Ambler

For more information on this top-quality gravity sewer pipe, write to: Keasbey & Mattison Company, Ambler, Pa.

MUELLER®

AWWA IMPROVED FIRE HYDRANTS





BRONZE WEATHER CAP—Keeps water away from operating nut and prevents tampering.

OIL FILLER PLUG—Check oil level quickly without removing bonnet.

OIL RESERVOIR—Automatically lubricates stem threads and bearing surfaces.

DRY TOP DESIGN—Threads and bearing surfaces are sealed from water.

"O" RING SEALS—Permanent, watertight, adjustment-free seal without binding.

BREECH-LOCKED NOZZLES—Interlocked and calked to prevent blow-out.

NON-KINKING CHAINS—Attached under each individual nozzle.

SAFETY STEM COUPLING—Breaks apart without bending the stem. Repaired in minutes without digging and with no loss of water.

SAFETY FLANGE—Separates cleanly on impact to prevent damage to barrel. Can be restored without shutting off water.

COMPRESSION-TYPE MAIN VALVE—Positively closed by water pressure. Of special wear and damage-resistant material. Permits repairs without shutting off water.

BRONZE SEAT RING—Straight threads, with copper-asbestos gasket, permits easy removal.

DOUBLE DRAIN VALVES—Empty barrel completely. Flushed with each use.

BRONZE CAP NUT—Locks stem and seals threads against corrosion.

WEATHERPROOF
. . . TAMPERPROOF
. . . TRAFFICPROOF
. . . MAINTENANCE-FREE!

Once set, you can forget about a Mueller Improved Hydrant. With little or no attention, the Mueller Hydrant is ready for action in any weather.

Write for complete information and specifications.

MUELLER CO. Since 1857 SERVANTS de Water and Gas Industries QUALITY 06273

MUELLER CO.
DECATUR, ILL.

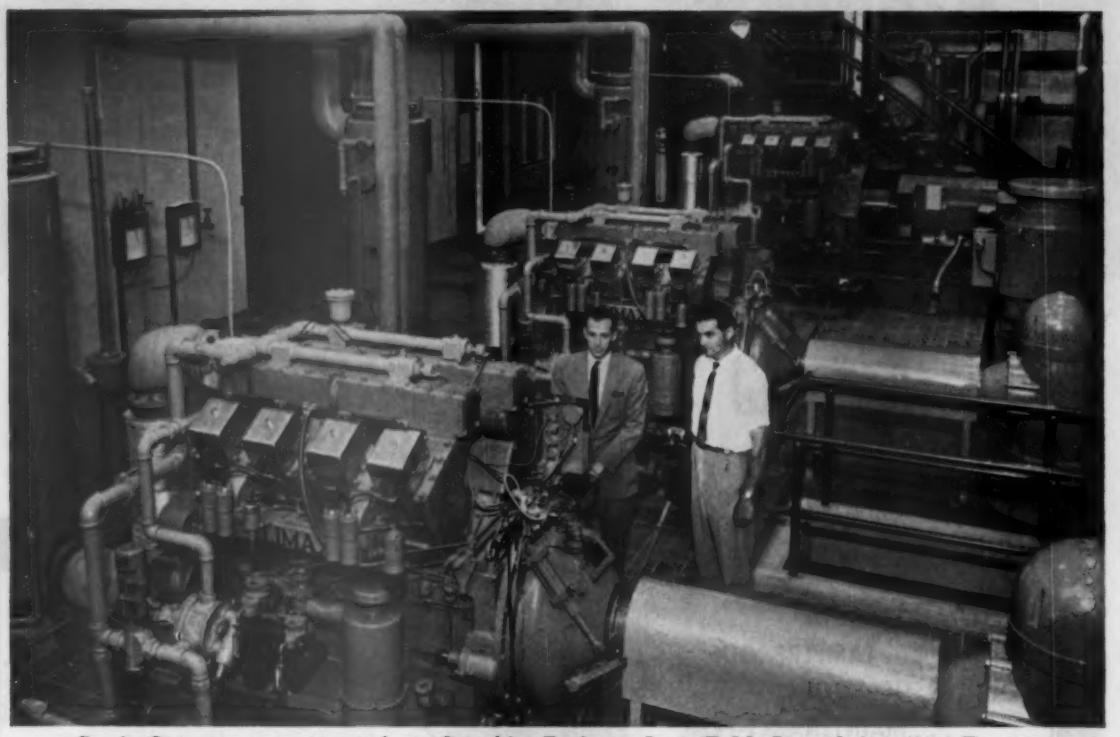
Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

Sarnia, Ontario's sewage treatment plant has

20 million gal. per day capacity

CLIMAX SEWAGE/NATURAL GAS V-85 ENGINES

power the pumps and all auxiliaries



Sarnia, Ont., sewage treatment plant. *Consulting Engineers:* James F. MacLaren & Associates, Toronto. *Prime Equipment Suppliers:* Babcock-Wilcox & Goldie-McCulloch Ltd., Galt, Ont. *Engines supplied by* Atlas Polar Company Limited, Toronto.

In Sarnia, Ontario's modern sewage treatment plant two Climax V-85 Engines pull the pumps; a third drives an alternator supplying all auxiliary power. These engines operate primarily on sewage gas with automatic change over to natural gas in case of a failure of the sewage gas supply. # Capacity of each Babcock-Wilcox pump is 10-million Imp. gal. daily at 880 rpm; 7-million gal. at 760 rpm; 3-million gal. at 640 rpm. A Woodward PG-PL hydro-pneumatic governor ensures infinitely variable low to high speeds. # The Climax Engines, sold by Atlas Polar Co. Ltd., Toronto, drive the pumps through right angle gears. Engine clutch-mounted air cylinders, controlled from master panel, provide automatic engagement and disengagement. Engines have Sims waste heat exhaust boilers, supplied by Climax; and coils in sludge tanks cool the engines so that waste heat from jackets is also used in sewage treatment. # The third Climax V-85, equipped with a Woodward UG8 governor, and direct-connected to the 125 KW, 900 rpm, 60-cycle Tamper alternator, is designed to operate continuously. It was built by Atlas Polar. These Climax V-85's are 8-cylinder, 60-degree, V-type, 7½-inch bore x 7-inch stroke, 2474 cubic inch engines. All three have Synchrostart safety shutdown control panels. Send for descriptive Bulletin SA-631.

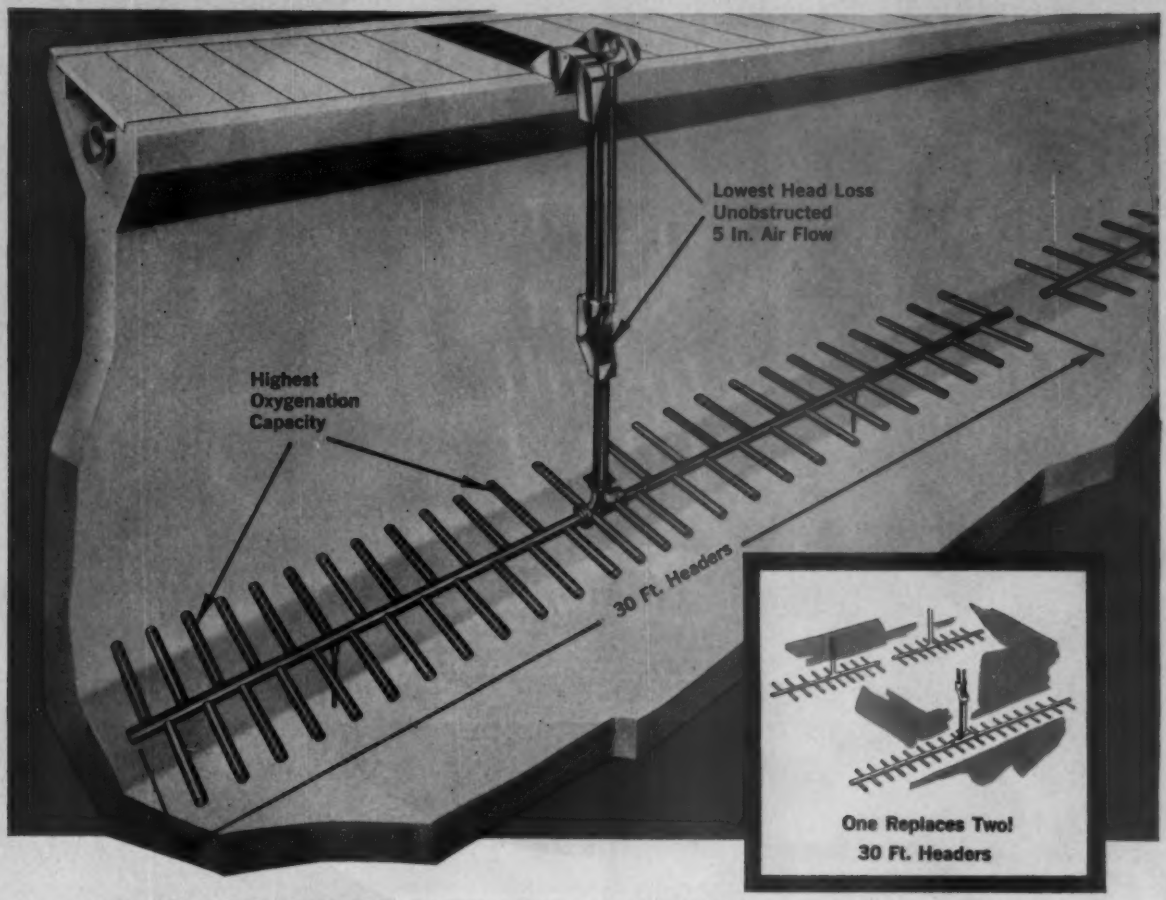
CL-122

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY

FACTORY—CLINTON, IOWA

"from Chicago" NEW SWING DIFFUSER . . .

DESIGNED FOR HIGHER CAPACITIES . . . LOWER COSTS



"MODEL 30"* SWING DIFFUSER PROVIDES GREATER ECONOMY WITH INCREASED OXYGENATION CAPACITY

- **Highest oxygenation capacity** . . . positive positioning of 5 inch diameter Swing Diffuser with loadings up to 115 "Precision" Diffuser Tubes.
- **Lower head loss** . . . Exclusive unobstructed air flow construction makes over 280% more air available from the Model 30 than is obtained from any single conventional unit; 40% more air than obtained from any two conventional units—at no increase in head loss.
- **Headers are 30 feet long** . . . fewer swing diffuser units necessary, lower installed costs.
- **Air leakage eliminated** . . . unique, sealed flexible connections eliminate leakage normally encountered through metal to metal faced joints.
- **Lubrication eliminated** . . . Stainless steel and Teflon lined joints eliminate need for lubrication.

IN ADDITION, the new Model 30 Swing Diffuser provides all the advantages of the famous "Chicago" Swing Diffusers proved successful in thousands of installations. Individual units are easily raised for cleaning and inspection without interruption of tank operation.

Ask for Bulletin No. 179

fmc CORPORATION

HYDRODYNAMICS DIVISION

CHICAGO PUMP

622H Diversey Parkway • Chicago 14, Illinois

©1961 CP-FMC

*U. S. PATENT NO. 2997284 Others Pending.

...15 seconds with Fairbanks-Morse Diesels

The F-M 38D8⅛ Opposed-Piston Diesel Generating Unit—with only 15 seconds *from cold start* to full power—gives fast, sure power for peaking or for standby use, together with impressive operating economies.

This unit requires no spinning reserve . . . uses no power until it starts, then produces up to 2500 kw per unit. Can be linked in multiple units.

Dependable? Service records of F-M Diesels prove dependability beyond a doubt (F-M pioneered the manufacture of diesels in America . . . has kept in the forefront ever since.)

Economical? The 38D8⅛ has 40% fewer moving parts than comparable engines of equal horsepower. This means reduced maintenance costs . . . fuel and lube oil savings.

Opposed-piston design minimizes vibration, produces fine balance . . . smooth power and instant response that result in 15 second full-power operation. Available with 4, 5, 6, 8, 10 or 12 cylinders, ranging from 450 to 2500 kw per unit, with automatic or manual controls. **For full details or custom specifications, write today to: S. K. Howard; Director of Marketing; Fairbanks, Morse & Co.; Beloit Division; Beloit, Wisconsin.**

FAIRBANKS MORSE
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY

BIF POSITIVE CONTROL OF MATERIALS FLOW

"$25,000 PER YEAR SAVED!"---City "A"

"MORE IMPORTANT TO US THAN SAVINGS WAS INCREASED OPERATING EFFICIENCY RESULTING IN IMPROVED SERVICE AND CUSTOMER RELATIONS!"---City "C"

"AMORTIZED IN 26 MONTHS!"---City "B"

Dependable Transistorized **B-I-F** *Supervisory Control Cuts Operating Costs of Widespread Systems*

"$25,000 per year saved" and "Amortized in 2 years and 2 months" . . . typical testimonials received from the many municipalities using B-I-F supervisory control systems . . . names upon request. Systems range in size from relatively compact layouts to operations spread over 100 square miles with more than 200 stations, valves and similar functions to control.

One operator, at a centralized control panel, knows instantly when irregularities occur at distant points . . . takes immediate corrective action. Report-back verifies that a valve is open or closed, that a particular pump has started or stopped, or that . . . through visual indication . . . the desired function is correctly recorded.

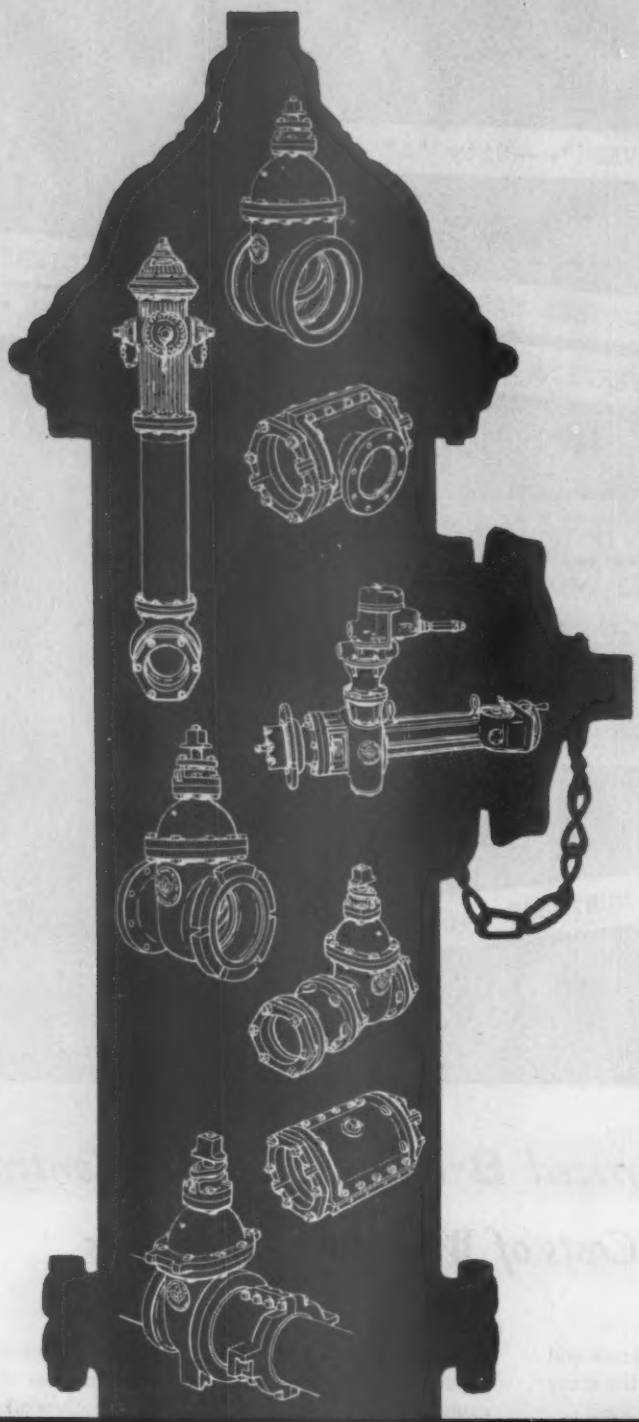
B-I-F Supervisory Control Systems employ many advanced, but performance-proved techniques to provide centralized control at low operating cost. Dependable, safe system reduces equipment costs, operating costs . . . provides for low cost system expansion.

Request Bulletin 0240.20-3 for complete details. Write B-I-F Industries, 350 Harris Ave., Providence 1, R. I.

BIF **Industries**

A DIVISION OF THE NEW YORK AIR BRAKE COMPANY

METERS • FEEDERS • CONTROLS / CONTINUOUS PROCESS ENGINEERING



For

HYDRANTS

For over half a century Smith Hydrants have performed faithfully — 24 hours a day — in cities large and small throughout the country. In New York, Providence, Philadelphia, Detroit, Baltimore, Toronto, St. Louis, Washington, D. C. and in many other cities Smith-designed hydrants have been adopted as standard.

VALVES

Smith metropolitan specification Gate Valves are produced in sizes 2" through 48" with all standard types of end connections for low, intermediate and high pressure service and are manual, cylinder or electric motor operated. Overall Valve size range is 2" through 66"

TAPPING SLEEVES, VALVES & MACHINES

In 1896 Smith introduced the Tapping Machine which revolutionized the making of 2" and larger connections (under pressure) to fluid and gas service piping, storage tanks, etc. The machines are used with Tapping Sleeves, Hat Flanges, Saddles and Tapping Valves to make pressure connections to Cast Iron, Cement-Asbestos, Steel and Reinforced Concrete piping. Overall size range 2" through 42".

CUT-IN VALVES & SLEEVES

Most economical way of installing additional or replacement Gate Valves (sizes 4" to 12") in existing piping which **can** be relieved of pressure.

REPAIR SLEEVES

Used to permanently repair and quickly return broken or cracked piping to service. Sizes 4" through 48".

INSERTING VALVES & MACHINES

Used to install under pressure additional Valves in existing water and gas service piping which **cannot** be relieved of pressure — size range 4" through 48".

LEADERS IN THE WATER WORKS FIELD SINCE — 1896

HYDRANTS — VALVES — SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE NEW JERSEY

Glenfield microstraining solves a Lake Michigan treatment problem

Mr. O. Fred Nelson, Kenosha, Wisconsin's City Water Manager has seen his expectations more than fulfilled since starting up his installation of four 10 ft. Microstraining units on July 1st.

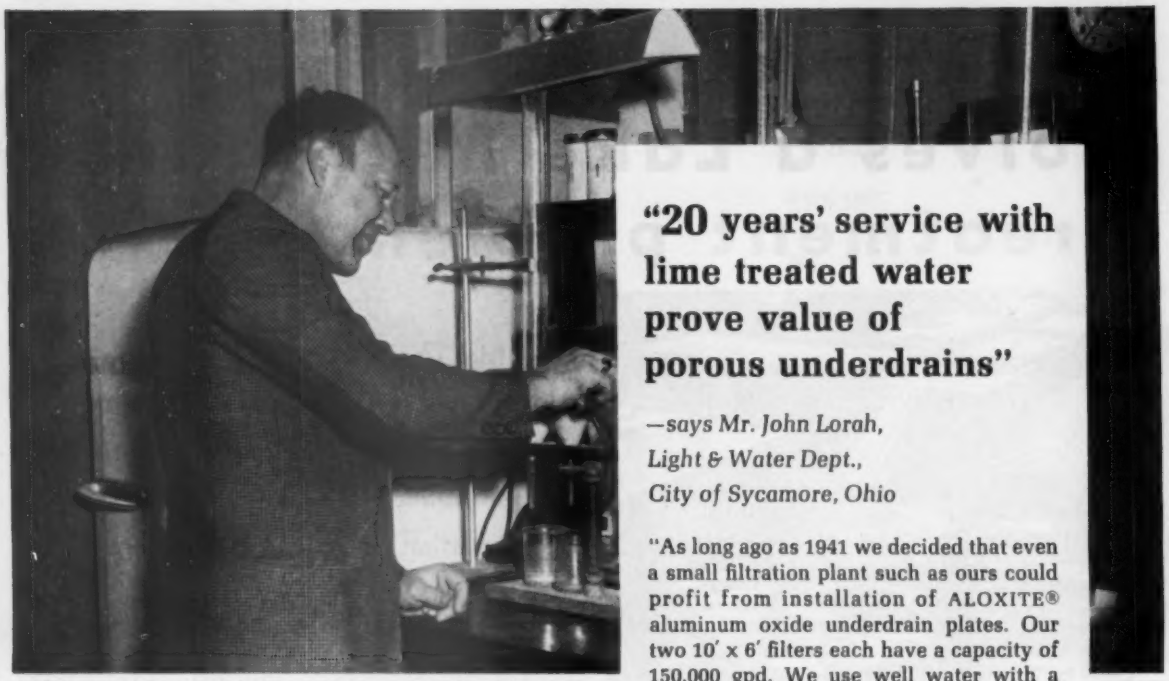
Filter runs in the existing conventional plant have improved from under 10 to over 50 hours.

Plant output has been materially increased and at the same time considerable economies have been effected in the consumption of wash water and of chemicals despite a heavy load of algae in the lake water.

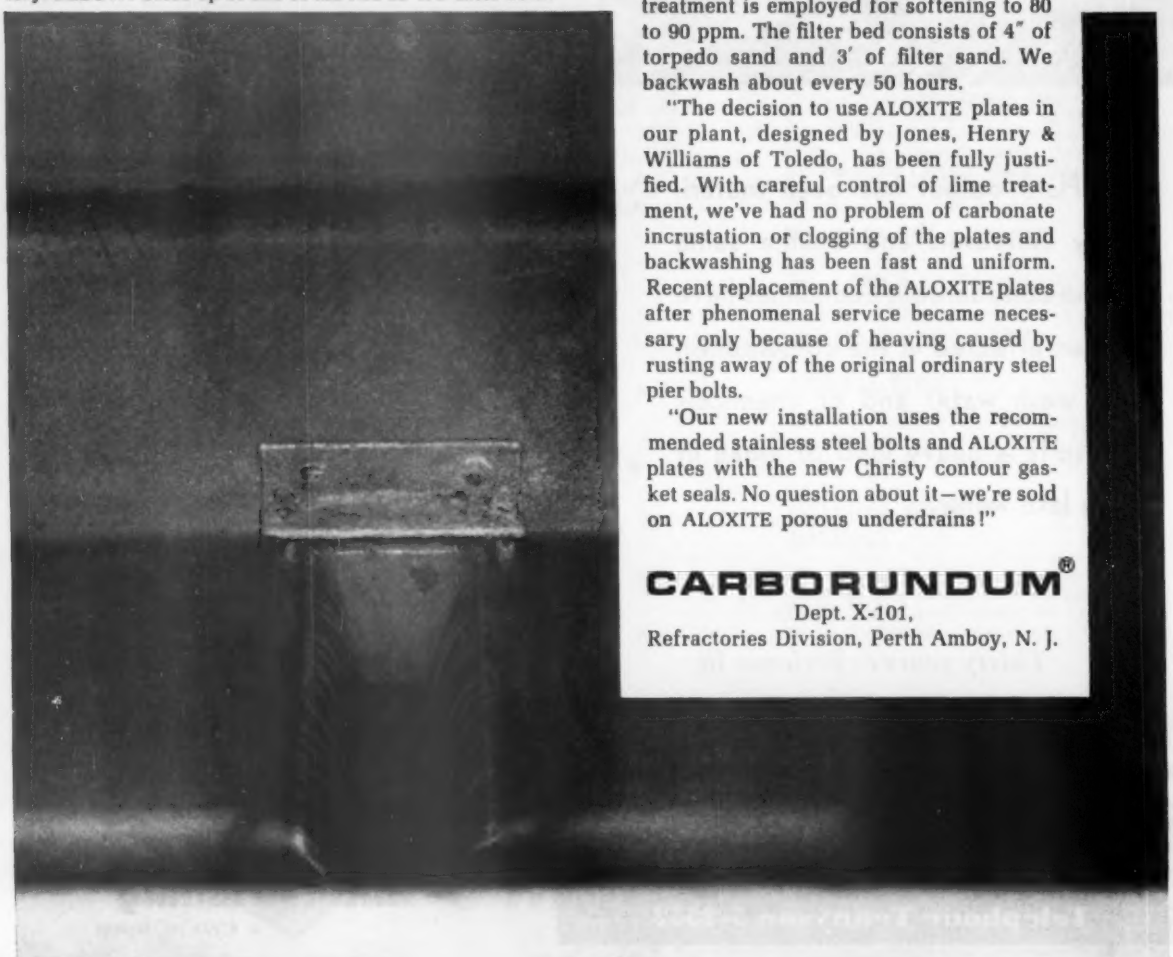
Alvord, Burdick & Howson, *Consulting Engineers*

Thirty years experience in rotary straining at your service

Glenfield & Kennedy, Inc.
275 Halstead Avenue
Harrison, New York
Telephone Tennyson 5-2552



ABOVE: Mr. John Lorah in the water treatment plant laboratory. BELOW: Close-up of one of the two 10′ x 6′ filter beds.



"20 years' service with lime treated water prove value of porous underdrains"

—says Mr. John Lorah,
Light & Water Dept.,
City of Sycamore, Ohio

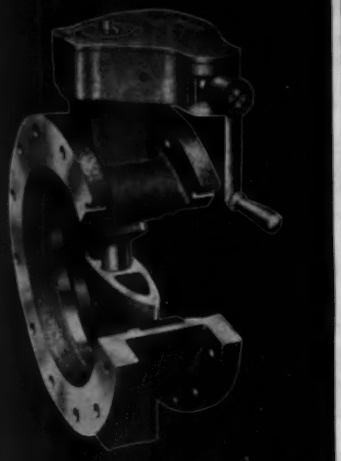
"As long ago as 1941 we decided that even a small filtration plant such as ours could profit from installation of ALOXITE® aluminum oxide underdrain plates. Our two 10′ x 6′ filters each have a capacity of 150,000 gpd. We use well water with a hardness of approximately 650 ppm. Lime treatment is employed for softening to 80 to 90 ppm. The filter bed consists of 4″ of torpedo sand and 3′ of filter sand. We backwash about every 50 hours.

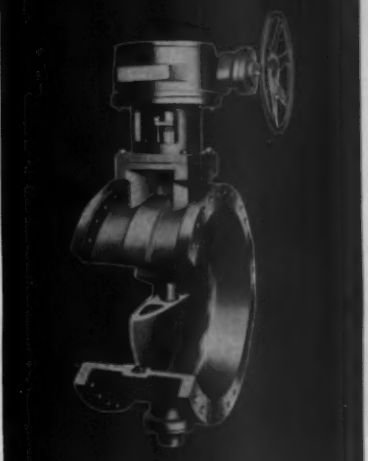
"The decision to use ALOXITE plates in our plant, designed by Jones, Henry & Williams of Toledo, has been fully justified. With careful control of lime treatment, we've had no problem of carbonate incrustation or clogging of the plates and backwashing has been fast and uniform. Recent replacement of the ALOXITE plates after phenomenal service became necessary only because of heaving caused by rusting away of the original ordinary steel pier bolts.

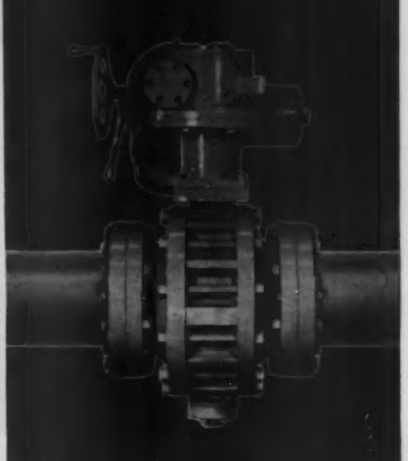
"Our new installation uses the recommended stainless steel bolts and ALOXITE plates with the new Christy contour gasket seals. No question about it—we're sold on ALOXITE porous underdrains!"

CARBORUNDUM®
Dept. X-101,
Refractories Division, Perth Amboy, N. J.

Now! PRATT STANDARD RUBBER SEAT VALVES FROM VACUUM TO 250 psi







150 psi Standard Valve Flanged or Monoflange

This Henry Pratt valve is loaded with extra values . . . the most *rugged construction* available . . . lower costs due to complete standardization . . . and economical *space savings* thru new narrow face-to-face dimensions in classes up to 125 psi . . . *new sidewinder operator* with manual, cylinder and motor types.

Highly versatile—available in 2 flange or monoflange types, with floor stand or extension bonnets, and completely sealed operators for buried service.

For AWWA classes 25-8 thru *125-16* in sizes 4″ thru 20″.

Write for Bulletin 6-B.

50 and 125 psi Standard Valves with adjustable seat

For the first time, 50 psi Standard Valves are available with economical narrow face-to-face dimensions thru the full 50-16 classification. The 125 psi Standard Valves in wide face-to-face offer traditional Pratt ruggedness in classes 50-8 thru 125-16. In all classes the valve seats are factory adjusted around their perimeter for the most precise fitting of disc to seat, a feature that offers:

Easier operation—with a precisely fitted seat.

Longer Life—accurate control of disc-seat interference provides tightness without wear.

Bubble-tight operation up to 150 psi.

Easy field adjustment . . . seats can be adjusted or even replaced without dismantling the valve or removing it from the line . . . and the seat fitting will be factory accurate.

Sizes 24″ thru 72″.

Described in Bulletin 6-B.

Pratt Rubber Seat Ball Valve for 150 and 250 psi

Resilient seating has now been applied to ball valves—putting the time-proved advantages of this seat to work at higher pressures and velocities than ever attained before.

The Henry Pratt Ball Valve offers bubble tight performance for ball or cone valve applications plus these definite advantages: *less weight, smaller size, lower operating torques* than similar valves . . . and *no more pressure drop than equivalent length of pipe.* The rubber seat will not bind or stick and compensates for line distortion. One man operation against full line pressure.

Complete line of operators and accessories. Ideal for buried service with enclosed operator. Sizes 10″ thru 48″.

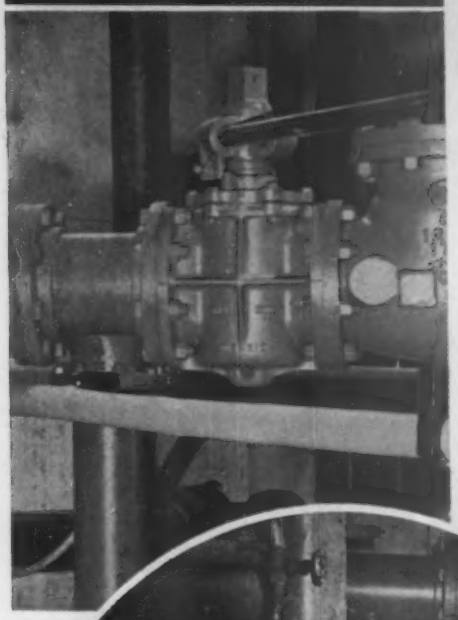
Write for Bulletin BA-1-B.

Creative Engineering for Fluid Systems

HENRY PRATT COMPANY
319 West Van Buren Street • Chicago 7, Illinois
Representatives in Principal Cities

HENRY PRATT®

DeZURIK Eccentric-Action VALVES

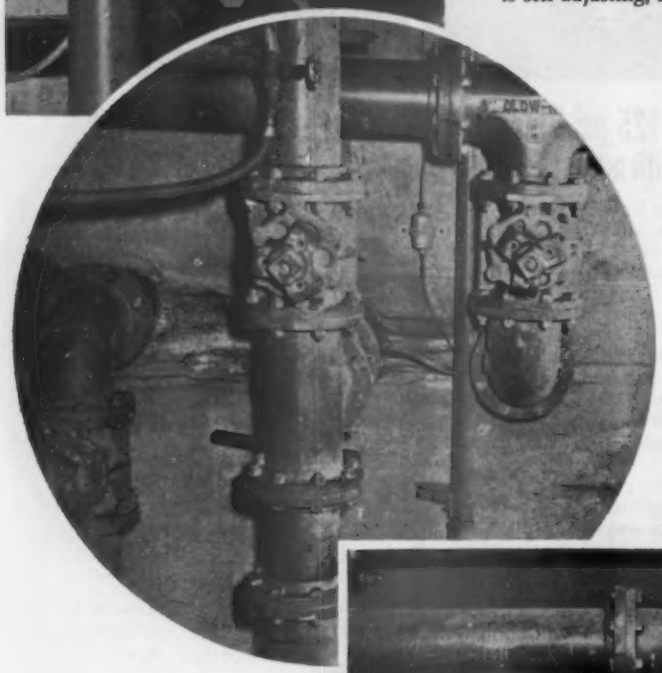


they say "NO!" to valving troubles

LEAK OR DRIP? **NO!**
LUBRICATION? **NO!**
BINDING OR SEIZING? **NO!**
MAINTENANCE PROBLEM? **NO!**
EXPENSIVE? **NO!**

ASK ANY of the hundreds of sewage or water plants using DeZurik Valves . . . they'll tell you that no valves say "NO" more often to valving problems.

ECCENTRIC-ACTION makes DeZurik Valves the most trouble-free ever developed. The eccentric resilient-faced plug delivers a cushioned, complete shut-off, sealing dead-tight every time on any flow. The plug never touches the valve body, can't ever rub or bind. Corrosion-resistant bearing bushings prevent freeze-up no matter how often or how seldom the valve is used. The easiest quarter-turn opens or closes a DeZurik Valve, with accurate throttling through the cycle. Leak-proof stem-seal is self-adjusting, rarely if ever needs repacking.

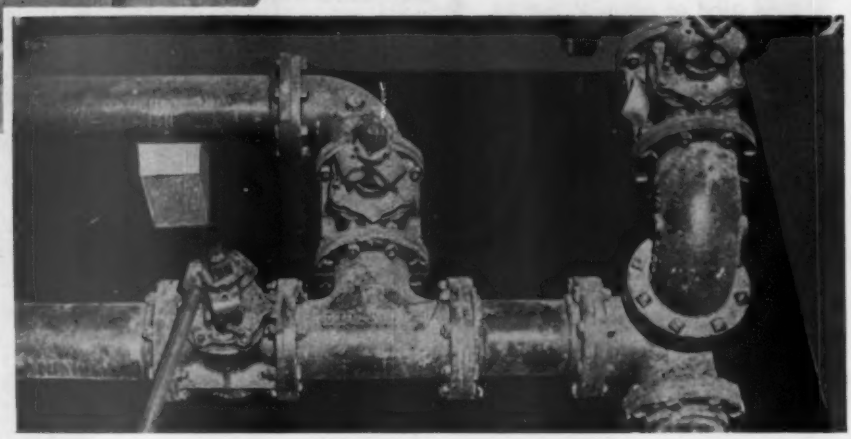


LOW IN COST, HIGH IN ECONOMY!

Size for size, DeZurik Valves are reasonably priced. They save many dollars through longer life without maintenance, and they repay their cost many times in their positive prevention of leaks and downtime.

DeZURIK ECCENTRIC-ACTION VALVES ARE AVAILABLE in sizes from ½" thru 30", for manual or automated service. Also available: DeZurik 3-way and 4-way Vee-Port Valve and DeZurik Knife-Gate Valves. WRITE FOR BULLETINS.

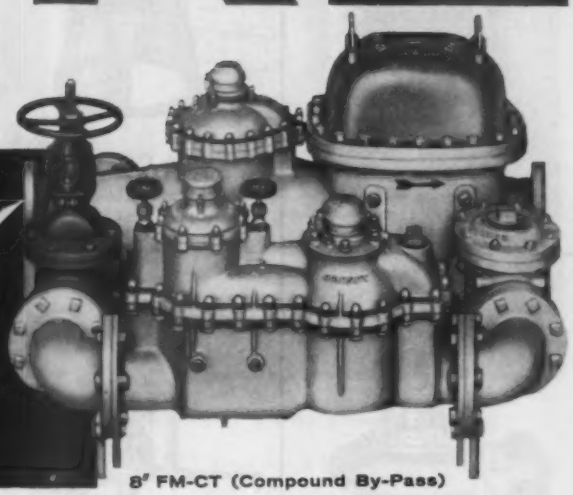
DeZURIK CORPORATION
SARTELL, MINNESOTA



Photos directly above and right: Some of the many DeZurik Valves in the new sewage treatment plant at New Albany, Ind., Consoer & Townsend, Consultants; Fruin-Colnon Contracting Co. and C&C Construction Co., Inc. Contractors.

MORE FIRE PROTECTION MORE REVENUE

HERSEY DETECTOR WATER METERS MODEL FM (FIRE SERVICE)



8" FM-CT (Compound By-Pass)

This meter accurately measures both small and large rates of flow as required in ordinary services. In addition, it will deliver, in an emergency, the full capacity of the supply pipe with minimum loss of head. It is specially designed for use in fire or automatic sprinkler lines . . . general plant service lines . . . master metering of connecting systems . . . and other applications where wide range of flows require accurate measurement with minimum head loss. Write for literature.

MODEL FM-CT (Compound)
Bronze By-Pass Meter
Sizes 4", 6", 8", 10", 10 x 12"
Also available with Disc By-Pass Meter.

Sizes 6", 8" and 10" of Model FM-CT with compound by-pass and sizes 3" through 10" with Disc by-pass are listed as standard under the Re-examination Service of Underwriter's Laboratories, Inc., and approved by Factory Mutual Laboratories for use in Factory Mutual insured properties, also listed by Underwriter's Laboratories of Canada.

Hersey-Sparling
Meter Company
HERSEY PRODUCTS
DEDHAM, MASSACHUSETTS

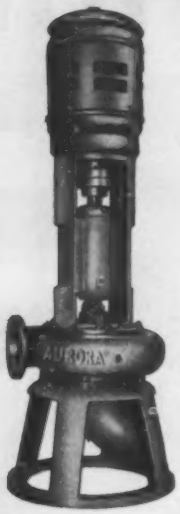
Branches: Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Kansas City, Mo., Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle.

OBJECTIVE PERFORMANCE

. . . EFFICIENCY AND ECONOMY WITH

AURORA® *Heavy Duty*

NON-CLOG PUMPS



TYPE KUC VERTICAL—For compact installation with flexible coupling drive... motor high above floor.

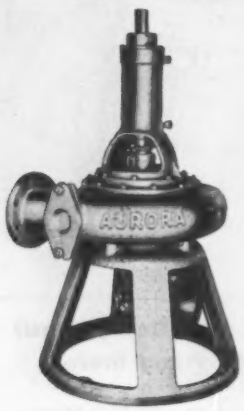
TYPE KCM VERTICAL—Utmost compactness... close-coupled design... low suction.

For handling heavy liquids... and solids in suspension. Ideal for public utility and industrial wastes.

Capacities to 9000 GPM • Heads to 150 feet • Solids size to 6 inches

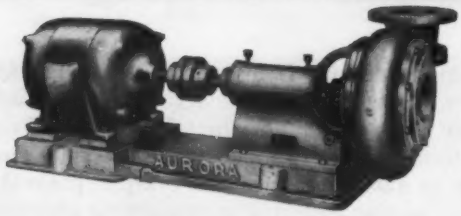
- Easy Installation
- Easy Disassembly
- Smooth—Quiet operation
- Hand cleanout provided in casings
- Detachable suction and packing covers
- Large Passageways
- Many optional features available
- Uniquely balanced impellers
- Engine or combination drives available
- Deep packing boxes

ALTERNATE IMPELLER DESIGN



TYPE KU VERTICAL—For flexible shaft drive... misalignment proof ...elevated motor protection against pit flooding.

TYPE KS VERTICAL—For heavy duty wet pit service. Complete unit engineered to specific pit requirements.



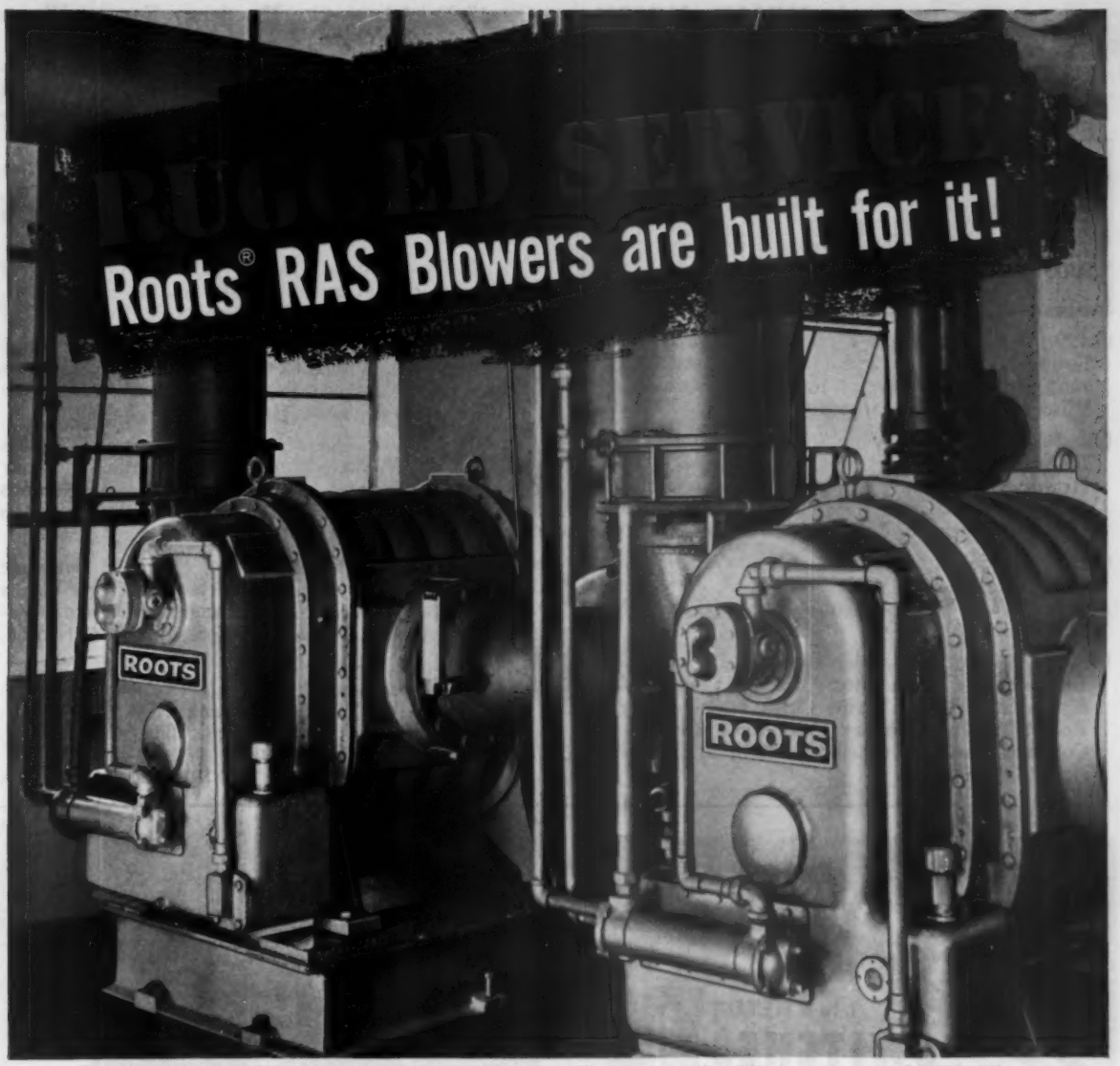
TYPE KGG HORIZONTAL—Rugged base mounted unit ...for use where suction conditions permit horizontal mounting.

WRITE TODAY
FOR NEW
NON-CLOG
BULLETIN

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
1020 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK



These RAS Blowers are in sewage treatment aeration service. They are rated 3000 CFM with discharge at 7.5 PSIG. RAS Blowers are suited to chemical processing, pneumatic conveying, metal working applications . . . wherever a blower is used.

Long periods of continuous operation? All round dependability? Oil-free air? Entrained liquid? Varying pressure? Limited installation space?

Roots RAS Blowers are built for demanding requirements. Rugged construction includes heavy stub-shafts bolted to segmental waist impellers, and conservatively rated pressure lubricated bearings.

RAS Blowers are gas tight, even for hot or light gases. Regardless of varying pressure they deliver a constant volume of oil-free air. Entrained liquids present no mechanical hazards.

Use RAS Blowers to solve your installation problems. Compact, completely enclosed construction not only saves space, it eliminates the need for a base-plate and provides full protection for outdoor installation. Side inlet and discharge connections simplify piping, too.

Roots RAS Blowers and RGS Gas Pumps are available in 36 sizes for handling capacities to 30,000 cfm and working pressures to 12 psig. For full details, request new illustrated Bulletin RAS-261.

ROOTS-CONNERSVILLE BLOWER DIVISION • 900 W. MOUNT ST., CONNERSVILLE, INDIANA
In Canada—Roots-Connersville Blower (Canada), Ltd. • 212 King Street, West, Toronto

CLARK® Engines, Compressors, Gas Turbines

Working together in allied industries . . .

PODBIELNIAK Centrifugal Contactors, Distillation Apparatus, Instrumentation

ROOTS **DRESSER INDUSTRIES INC.**
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

Meetings

WHAT WHEN WHERE

1961

OCTOBER							NOVEMBER							DECEMBER						
1	2	3	4	5	6	7	.	.	.	.	1	2	3	.	.	.	.	.	1	2
8	9	10	11	12	13	14	5	6	7	8	9	10	11	3	4	5	6	7	8	9
15	16	17	18	19	20	21	12	13	14	15	16	17	18	10	11	12	13	14	15	16
22	23	24	25	26	27	28	19	20	21	22	23	24	25	17	18	19	20	21	22	23
29	30	31	.	.	.	.	26	27	28	29	30	.	.	24	25	26	27	28	29	30
.	.	.	.	.	.	.	.	.	.	.	.	.	.	31	.	.	.	.	.	.

Oct. 9-12—Milwaukee, Wis. (*Schroeder Hotel*) THIRTY FOURTH ANNUAL MEETING WATER POLLUTION CONTROL FEDERATION. Secy., Ralph E. Fuhrman 4435 Wisconsin Ave., Washington 6, D. C.

Oct. 9-20—Cincinnati, Ohio (*Robert A Taft Sanitary Engineering Center*) Short Course: Basic Radiological Health. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

Oct. 15-18—San Antonio, Texas (*Hilton Hotel*) SOUTHWEST SECTION A.W.W.A. Secy., L. A. Jackson, Municipal Water Works, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-27—Cincinnati, Ohio (*Robert A. Taft Sanitary Engineering Center*) Short Course: Plankton Identification and Control. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

Oct. 17-20—Atlantic City, New Jersey. EASTERN WATER CO. CONFERENCE

Oct. 17-Nov. 9—New Brunswick, N. J. (*Rutgers University*) Short Course: Sewage Disposal and Plant Operation. Contact Dean, College of Engineering, Rutgers, The State University, New Brunswick, N. J.

Oct. 18-20—Cedar Rapids, Iowa (*Roosevelt Hotel*) IOWA SECTION A.W.W.A. Secy., Wilbur E. Bjork, Des Moines Water Works, 1003 Locust St., Des Moines.

Oct. 22-25—Montreal Quebec (*Mount Royal Hotel*) CANADIAN INSTITUTE ON SEWAGE & SANITATION. Secy., Albert E. Berry, 72 Grenville St., Toronto, Ont.

Oct. 23-25—Pittsburgh, Pa. (*Penn-Sheraton Hotel*) INTERNATIONAL WATER CONFERENCE OF THE ENGINEERS SOCIETY OF WESTERN PENNSYLVANIA. Write: Society Office, Penn-Sheraton Hotel, Pittsburgh 30, Pa.

Oct. 23-27—Monticello, Illinois (*Allerton House*) TENTH ANNUAL WATER WORKS MANAGEMENT SHORT COURSE. Sponsored by Illinois and Indiana Sections A.W.W.A. Write: Short Course Supervisor, 116b Illini Hall, Champaign, Ill.

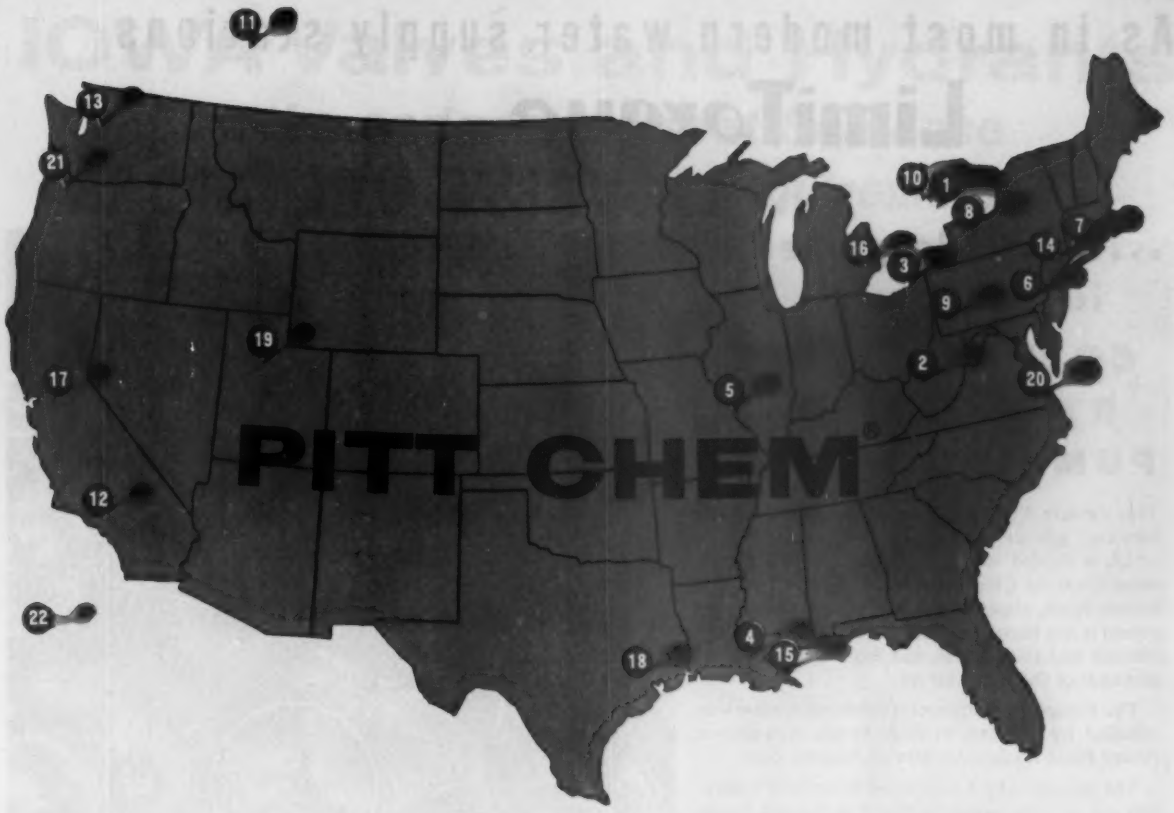
Oct. 23-27—Neosho, Missouri (Water & Sewerage Technical School) Short Course: Sewerage Works Course No. 1. Write: Lloyd Caughran, Director, Water & Sewerage Technical School, Box 348, Neosho, Mo.

Oct. 25-27—Sacramento, Calif. (*Hotel Senator*) CALIF. SECTION A.W.W.A. Secy., Frank F. Watters, Hydr. Engr., State Utilities Com., State Bldg., Civic Center, San Francisco.

CONTINUED ON PAGE 100A

SPEED SENSITIVE
1 to 6 ELEMENT
SWITCHES
OVERSPEED
One S.P.D.T. switch to trip at speeds between 350 and 6,000 RPM.
OVER AND UNDERSPEEDS
Two S.P.D.T. switches to trip at two different speeds between 300 and 6,000 RPM.
UNDERSPEED
One S.P.D.T. switch to trip at speeds as low as 250 RPM. Maximum operating speed 5,000 RPM.
OVER INTERMEDIATE AND UNDERSPEED
Six S.P.D.T. switches to trip at six different speeds between 300 and 6,000 RPM.
EXPLOSION PROOF AVAILABLE
The switches listed above are available with explosion proof containers that meet all of the specifications of Class 1, Group D, explosion proof equipment.
For further information ask for Bulletin 604
SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE., SKOKIE, ILL.

YOUR BEST WAY TO SAVE MONEY...the
HYDRO SILICA
CLEANING UNIT
Pays for Itself by....
• Extended Filter Cloth Life
• Less Down Time
• More Efficient Dewatering
• Better Sludge Cake
• Cleans Transmission Lines
DEMONSTRATION UNITS are available to show how effectively the Hydro Silica Unit will pay for itself in your plant. Write for descriptive literature.
HYDRO SILICA CORPORATION
GASPORT, NEW YORK



A Proven Way to Map an Efficient, Cost-Saving Corrosion Prevention Program

PITT CHEM INDUSTRIAL COATINGS

Distributors & Agents

1. **Allied Basic Chemical Co., Ltd.**
35 Anderson Avenue
Toronto 12, Ontario, Canada
2. **Allied Services, Inc.**
160 Spring Street
Charleston, W. Va.
3. **Bodwell-Lemmon Company**
10701 Broadway
Cleveland 25, Ohio
4. **Construction Materials, Inc.**
474 North Foster Drive
Baton Rouge, Louisiana
5. **Corrosion Products, Inc.**
5627 Manchester Ave. (Box 6065)
St. Louis 10, Missouri
6. **East Coast Distributors, Inc.**
1518 Brandywine Street
Philadelphia 30, Pa.
7. **The Eaton Corporation**
190 Henry Street
Stamford, Connecticut
8. **John J. Gordon**
220 Broadway
Buffalo 4, New York
9. **G. V. Hamilton**
326 Linden Avenue
McKees Rocks, Pa.
10. **Insul-Mastic Eastern, Ltd.**
1454 Bloor Street, West
Toronto 9, Ontario, Canada
11. **Magnachem, Ltd.**
5507 First Street, S.E.
Calgary, Alberta, Canada
12. **Magna Products, Inc.**
11808 South Bloomfield Ave.
Santa Fe Springs, Calif.
13. **Marine & Industrial Supply Co.**
1123 West Hanford Street
Seattle 4, Washington
14. **John E. Nicholson Co., Inc.**
426 East 110th Street
New York 29, New York
15. **Pat O'Neal Enterprises**
P. O. Box 164
Harvey, Louisiana
16. **W. C. Peters Company**
11111 Sturgis Street
Detroit 34, Michigan
17. **T. H. Pitt Company**
1133 Maripasa Street
San Francisco 7, Calif.
18. **Stockdale, Inc.**
P. O. Box 19085
Houston 24, Texas
19. **Robert Taylor & Sons**
P. O. Box 1223
Salt Lake City 10, Utah
20. **C. E. Thurston & Sons, Inc.**
850 Tidewater Drive
Norfolk, Virginia
21. **Waterworks Supplies Company**
4455 South East 24th Street
Portland 14, Oregon
22. **Gaspro, Ltd.**
P. O. Box 2454
Honolulu 4, Hawaii

A solution to *your* toughest corrosion problem is as "handy" as your nearest Pitt Chem Industrial Coating Distributor. These specialists in corrosion prevention are located strategically throughout the United States.

Whether you are interested in developing a complete, preventive maintenance program for your plant facilities, or are stymied with a specific corrosion problem, your Pitt Chem Distributor is geared to offer you complete assistance. His experience in solving a broad range of corrosion problems enables him to recommend the most effective and economical Pitt Chem protective coating program for you.

Call your Pitt Chem Distributor, he's listed in the Yellow Pages . . . get complete information on durable, economical Pitt Chem Coating Systems. 3306

PROTECTIVE COATINGS DIVISION

PITTSBURGH CHEMICAL CO.

GRANT BUILDING PITTSBURGH 19, PA.

A Subsidiary of PITTSBURGH COKE & CHEMICAL CO.

As in most modern water supply stations

LimiTorque MOTORIZED VALVE OPERATORS

...are widely used in the new COLUMBUS, GA. RAW WATER PUMPING STATION

This modern Pumping Station, located at Columbus, Ga., gets its power from the new Oliver Dam which is located next to it . . . The Station pumps water from the Chattachoocee River up to the Filtration Plant, about one mile away . . . During the period it has been in operation, it has proved to be efficient and economical, and has met the growing demands of the area it serves.

The Pumping Equipment for this fine station was installed by Burford, Hall & Smith, well-known Power Plant Equipment firm of Atlanta, Ga.

The reasons why LimiTorque Motorized Operators are so widely used in Water & Sewage Plants (as well as most all other types of Industrial Plants) is because they are accurate, safe, convenient, long-lived, economical and absolutely dependable . . . In addition to all these attributes, LimiTorque prevents any possible damage to vital operating parts in closing, due to a unique torque limiting mechanism.

LimiTorque can be easily field-mounted on existing valves . . . and remember LimiTorque is backed by nearly 30 years experience, plus the modern facilities and reputation of one of the World's largest manufacturers of Gears and Geared Products.

For further information about LimiTorque—consult your valve manufacturer or nearest LimiTorque Sales-Engineering Office.

Send for LimiTorque Bulletin #1-60, and please use your Business letterhead when requesting.

*This Plant was designed by Robert & Company Associates, Consulting Engineers, Atlanta, Ga.

THERE IS NO SUBSTITUTE FOR

LimiTorque®

PHILADELPHIA GEAR CORPORATION
KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.
Offices in all Principal Cities

PRECISION GEARS • INDUSTRIAL GEARS • SPEED REDUCERS • FLUID MIXERS • FLEXIBLE COUPLINGS
Limitorque Corporation • King of Prussia, Penna.

IOWA Valves and Hydrants

by the carload to meet San Jose Water Works' growing requirements

Glimpse of new subdivision of San Jose, California. City has grown from 95,280 to 202,571 in past ten years.

Unloading scene as IOWA hydrants are delivered by the carload to San Jose Water Works.

Two IOWA gate valves and a new hydrant being installed. Hundreds of these Iowa products are important components of San Jose's modern system.

Carloads of IOWA gate valves and hydrants were purchased by the San Jose Water Works (an investor-owned, private company established in 1866) for installation in their rapidly expanding system which serves seven cities and unincorporated areas in Santa Clara County, California.

Over 17,000 new water service connections were made in the last two years along 1200 miles of water mains to help care for a metropolitan population (Approx. 306,000) which has doubled since 1950.

IOWA products were selected to be a part of the San Jose Water Works' growth because of their proved dependability with minimum maintenance and assurance of long-life performance.

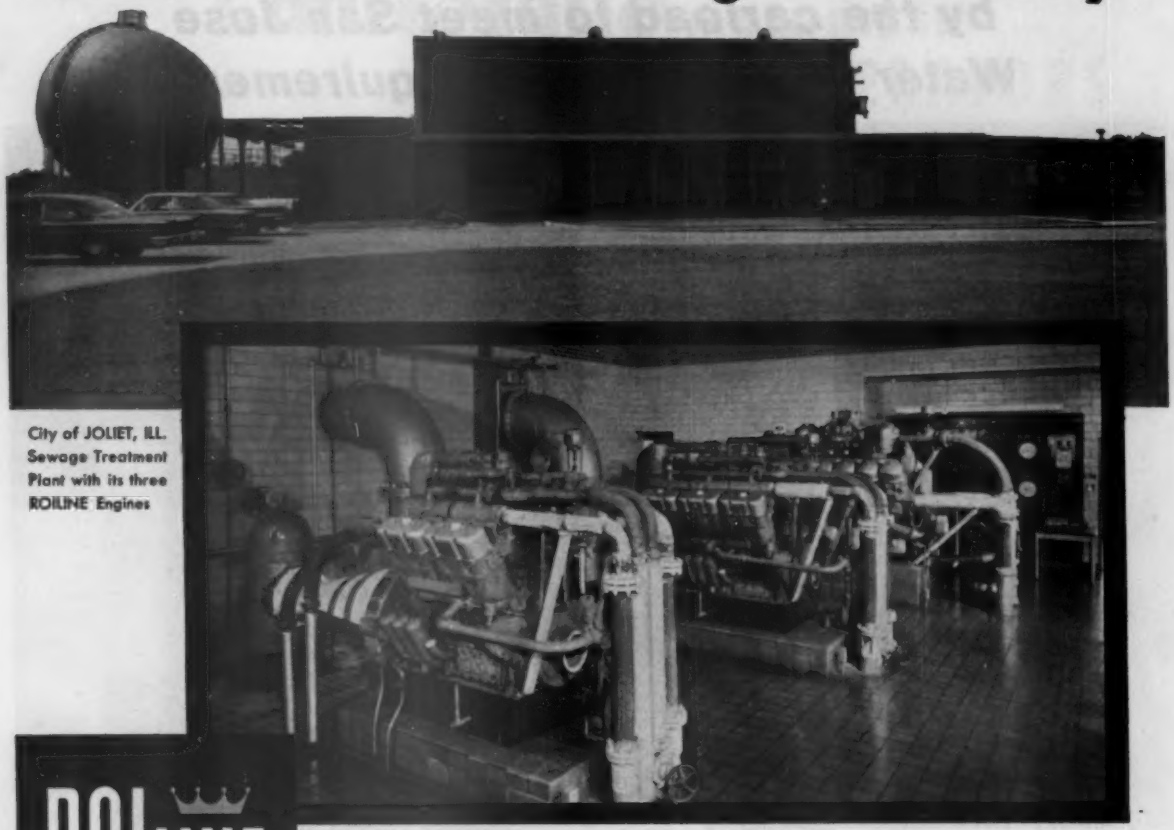
Every year more and more IOWA valves and hydrants are installed to serve the needs of growing communities like San Jose. Experience shows that IOWA products have that extra quality of materials, that extra-precise fitting and assembly that makes for longer life and easier maintenance.

Let us send you details on the complete IOWA line

IOWA VALVE COMPANY
Oskaloosa, Iowa
Subsidiary of James B. Clow & Sons, Inc.

a CLOW Subsidiary

PUMPING 15 million gallons daily



City of JOLIET, ILL. Sewage Treatment Plant with its three ROILINE Engines

ROILINE ENGINES do it *with sewage gas fuel*

Pumping fifteen to twelve million gallons! Joliet's city sewage treatment plant does it—every day.

The Worthington sewage pumps are driven through Amarillo right angle gears by ROILINE Engines *using sewage gas for fuel.*

ROILINE Model L-3000 runs *continuously,* 107 hp at 545 rpm, capacity 10,400 gpm; 12-cyl., 6¾-in. bore x 7-in. stroke, 3006 cu. in. displ.

ROILINE Model H-2000 as an *auxiliary,* 75 hp at 637 rpm, capacity 7,300 gpm; 8-cyl., 6¾-in. bore x 7-in. stroke, 2004 cu. in. displ.

ROILINE Model L-3460 as a *standby,* 151 hp at 530 rpm, capacity 15,300 gpm; 12-cyl., 7¼-in. bore x 7-in. stroke, 3468 cu. in. displ.

Send for literature • *SEE YOUR ROILINE ENGINE DISTRIBUTOR* 517

ARIZONA, Casa Grande, Engine Service Company, Inc.
ARKANSAS, Paragould, Wonder State Manufacturing Co.
CALIFORNIA, Long Beach and Bakersfield Engine & Equipment Company
COLORADO, Denver, Emrick & Hill Engine & Equipt. Co.
KANSAS, Garden City and Great Bend Carson Machine & Supply Co.
LOUISIANA, New Orleans and Shreveport Southern Engine & Pump Co.
MICHIGAN, Reed City, Hafer Engine Company
MINNESOTA, Minneapolis, Central Equipment Co.
MISSISSIPPI, Jackson, Southern Engine & Pump Co.
NEW JERSEY, Kenilworth, Callahan Equipment Co.
NEW YORK, Syracuse, Schenectady and Lisbon J. C. Georg Corporation
OHIO, Columbus, Cantwell Machinery Company
OKLAHOMA, Oklahoma City and Tulsa Carson Machine & Supply Co.
PENNSYLVANIA, Pittsburgh, P. C. McKenzie Company Bradford, R. R. Reck Company
TEXAS, Houston, Dallas, San Antonio, Kilgore, Corpus Christi, Beaumont Southern Engine & Pump Co.
Lubbock, Farmers Supply
Odessa, General Machine & Supply, Inc.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipt. Co.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. / **New York • Tulsa • Huntington Park, Calif.**
Factories: Waukesha, Wisconsin and Clinton, Iowa

Consulting Engineer: Finkbeiner, Pettis & Strout Contractor: Marcellette & Son Construction

Six 42" Darling-Pelton Iron Body Butterfly Valves are used on Oregon, Ohio's main water trunk line. Low operating costs, lasting safety and efficiency are essential "by-products" of this installation. Bodies, discs, and stainless steel shafts of these valves are all of sturdy construction. Discs are contoured to give minimum resistance to flow while providing necessary rigidity for maximum torque conditions. Manual operators—weatherproof and lifetime lubricated—are built to AWWA Specifications.

Darling-Pelton Butterfly Valves have a continuous 360° rubber sealing ring for drop-tight shutoff. The disc lifts away from the rubber valve seat on opening to eliminate abrasion and distortion. Darling also makes butterfly valves that can be installed with concrete pipe without the use of special fittings.

Darling-Pelton Butterfly Valve with manual operator. No adaptors are necessary when converting from a manual to either a hydraulic or pneumatic cylinder operator.

Like Oregon, Ohio, *you can depend on Darling*-Pelton Butterfly Valves to provide efficient, low cost, safe control on all your lines. Write, wire or phone for information.

DARLING VALVE & MANUFACTURING COMPANY
Williamsport 11, Pa.

The Canada Valve & Hydrant Co., Ltd.
Brantford 7, Ontario, Canada

Vannes Darling-France, 23 rue du Commandant Mouchotte,
St. Mandé, France

GATE • BUTTERFLY • CHECK • SPECIAL VALVES • FIRE HYDRANTS

ENTERPRISE *TRI-FUEL* ENGINES

SAVE 75 PERCENT OF FUEL COSTS AT BOWERY BAY

- *great versatility*
- *fast change-over*
- *automatic cut-back*
- *high output at low cost*
- *with Select-O-Matic® Controls*

Enterprise Select-O-Matic® Control sets the engine on either diesel or dual fuel operation. This single control automatically determines the ratio of fuel oil to gas, insuring continuous service and sustained optimum combustion efficiency, and prevents loss of engine power and speed.

Four Enterprise Model TDSQ 318 Tri-Fuel Engines at the Bowery Bay Pollution Control Project, Astoria, New York, are saving the cost of three quarters of the fuel required for treating sewage. Each is an eight-cylinder supercharged Enterprise Engine rated 1755 HP at 360 RPM and would normally consume 2,000 gallons of fuel per day; but by utilizing the free sewage gas (methane), produced by sludge digestion, requires an average of only 500 gallons in dual fuel operation.

The versatile Tri-Fuel Enterprise Engines perform triple services in the Bowery Bay Plant, supplying (a) power to pump 100 million gallons of sewage per day; (b) power for four 1,000 HP induction motors that drive four 25,000 CFM air compressors; (c) heat to maintain a 90 degree temperature in the sludge heating systems, and comfortable heating for the buildings.

Whether your municipal power requirements are greater or less than the Bowery Bay Project, there is a complete line of dependable heavy-duty Enterprise Engines available, for diesel fuel, dual-fuel, tri-fuel, or spark ignition operation. Models from 73 to 7703 HP. Contact us today for the full story.

ENTERPRISE Engines

Power Division of General Metals Corporation
550 85th Ave., Oakland 21, Calif. • 37-02 48th Ave., Long Island City 1, N.Y.
National and worldwide sales and service

A SUBSIDIARY OF TRANSAMERICA CORPORATION

BLESSINGS OF DIVERSIFICATION

In the past year the pace of sales and application of the Coilfilter, especially on Fresh Solids Dewatering, has continued to hold up remarkably well when we realize that while the disposal of sludges continues to be a vexing problem, other matters in the Sanitary Field have become more pressing.

On a nation-wide basis it is apparent that better effluents are required to keep pollution under control and we are hearing the word "tertiary" treatment used more frequently. We are also watching the gradual evolution of Federal participation in pollution control aid in the drainage basins.

Our research and development people have been cognizant of these ever growing needs and we are pleased to note that the line of equipment we manufacture is well suited for the needs of the Sanitary Field. The range includes such items as the homely ejector at one end and advanced electronic devices at the other extreme.

All items of equipment we manufacture are built to meet the needs of the Operator and are conservative in design. Our good reputation was built on this philosophy and we are indeed happy with the eminent position gained.

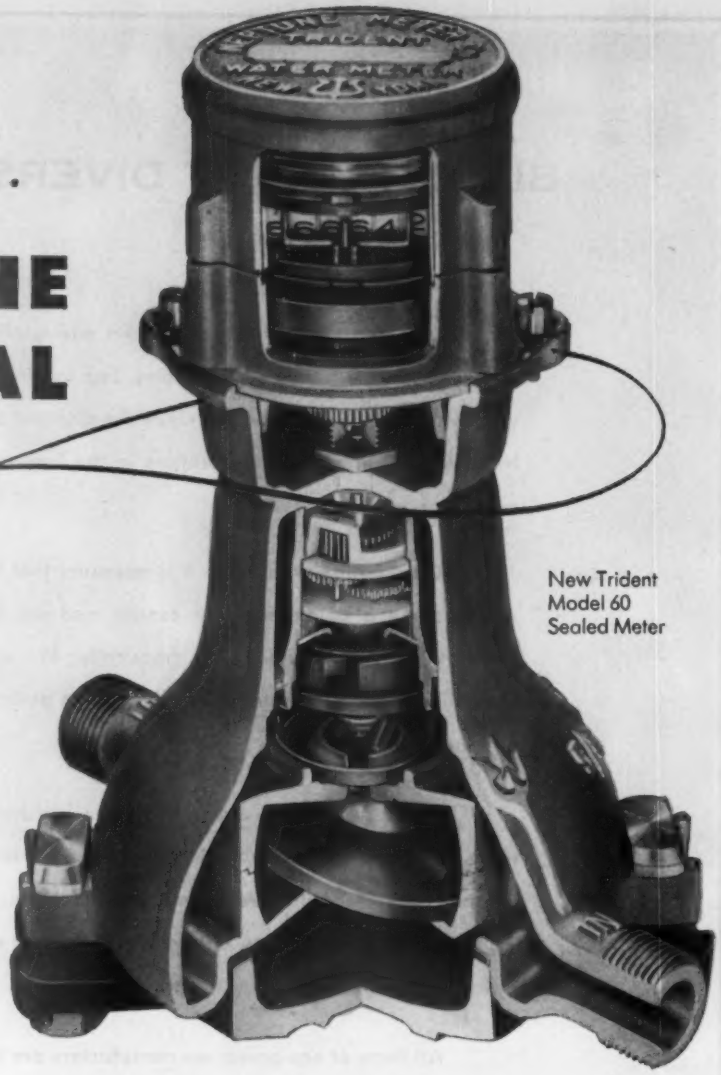
Respectfully,

T. R. Komline

KOMLINE-SANDERSON
ENGINEERING CORPORATION
PEAPACK, NEW JERSEY, U. S. A.
BRAMPTON, ONTARIO, CANADA

When you open the water meter bids...

ADD UP THE TRUE TOTAL



New Trident
Model 60
Sealed Meter

BID PRICE

+

OTHER COSTS:

Revenue losses

Repairs

Obsolescence
(if any)

THEN make the best buy...

A water meter should be a lifetime purchase. Its price tag gives only *part* of its cost. Look instead for *true annual costs:*

First, think of revenue loss. A meter returns 12 to 20 times its price before its first check-up. A slight slip in accuracy loses more money than you "save" in a low bid.

Secondly, meters must be tested regularly. One that checks OK *without* repairs obviously is worth more. In the long run, the meter that is *easiest* to repair is also worth more.

Finally, with most meters you must add obsolescence. But not with Trident. A Trident constantly modernizes itself. All design improvements are made to fit older Tridents too; you get them *automatically* as you insert replacement parts.

Trident meters are designed not for low bid but for low true annual cost. That's why Trident is always your "best buy."

Ask your Neptune representative.

neptune

LIQUID METER DIVISION • 47-25 34th Street, Long Island City 1, N. Y.

OFFICES IN PRINCIPAL CITIES • In Canada: Neptune Meters Ltd., 1430 Lakeshore Rd., Toronto 14, Ont.

Vol. 108, No. 10 • October 1961
WATER & SEWAGE WORKS
A Scranton Gillette Publication

DIGESTION UNITS, First Phase of Metropolitan Syracuse Treatment Plant.

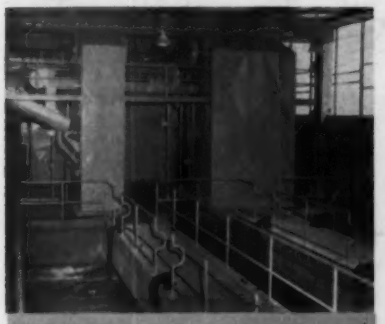
Beauty and efficiency combined in the . . .

METROPOLITAN SYRACUSE TREATMENT PLANT

by SAMUEL W. WILLIAMS JR.
O'Brien & Gere
Consulting Engineers
Syracuse, N. Y.

■ THE CITY of Syracuse is located at the southern end of Onondaga Lake. The five-mile-long lake has a great potential as a center for recreational activities, but waste discharges from the city and surrounding areas have so polluted the lake that its use for recreation has been seriously impaired.

There has been a sewage treatment plant in Syracuse since 1926, but in recent years the plant has been seriously overloaded and its efficiency has been poor. In addition, raw sewage has been discharged from the Village of Solvay and other areas on the west side of the Lake, and the Village of Liverpool sewage treatment plant located on the east side of the lake has been overloaded.



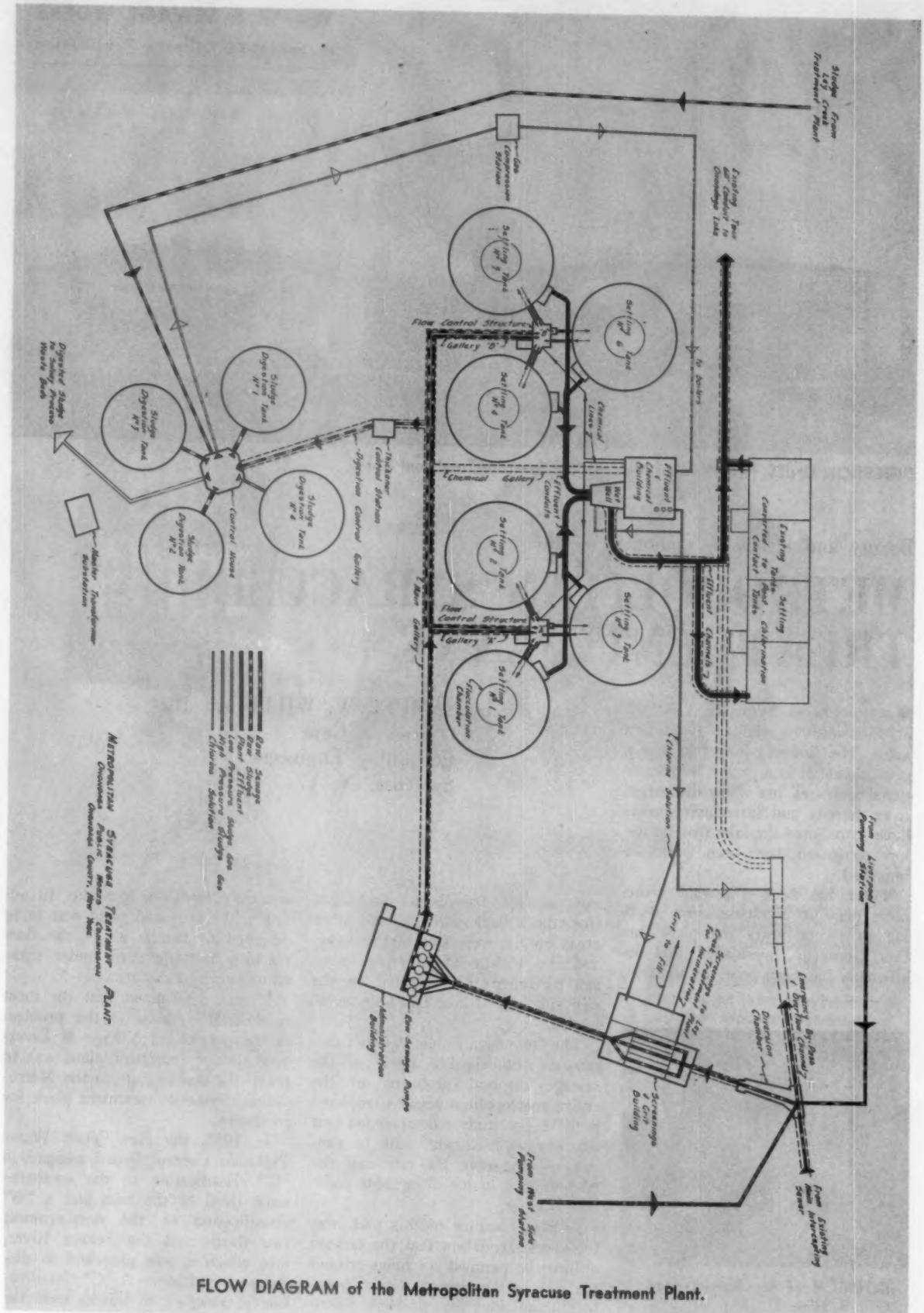
INTERIOR of the Screening and Grit Building.

The Onondaga Public Works Commission authorized a study of the sewage disposal problems of the entire metropolitan area. Completed in 1952, the study recommended that one sewage treatment plant be constructed to serve the city and the communities in the West Side Sanitary District.

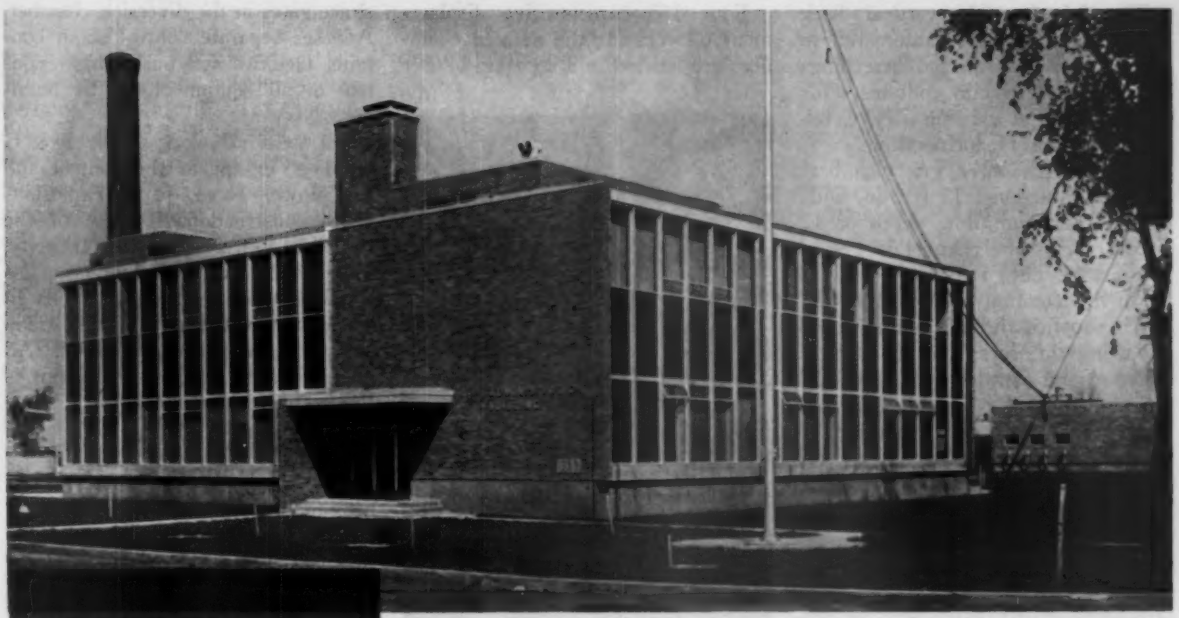
A novel feature of this plan was the recommendation that the treated effluent be pumped six miles around the lake to the Seneca River, thereby minimizing the problems with aquatic growths in the lake. In addition, the proposed plant was to be designed to handle all of the flow reaching the site even under maximum storm conditions.

It was determined that the most economical solution to the problem of the overloaded Village of Liverpool sewage treatment plant was to pump the raw sewage to the Metropolitan Syracuse treatment plant for treatment.

In 1953, the New York Water Pollution Control Board assigned a "C" classification to the southernmost third of the lake and a "B" classification to the northernmost two thirds and the Seneca River, into which it was proposed to discharge the effluent. A "C" classification is assigned to waters used for



FLOW DIAGRAM of the Metropolitan Syracuse Treatment Plant.



ADMINISTRATION Building.

only boating and fishing. A "B" classification is for recreational waters including swimming.

It was determined that primary treatment would be required during the non-recreational months, with chemical precipitation and chlorination during the swimming season. Accordingly, the design of the new Metropolitan Syracuse Sewage Treatment Plant was based on this degree of treatment.

The plant is designed to treat an average flow of 50 mgd with a normal dry weather peak flow of 67 mgd and a peak storm flow of 170 mgd.

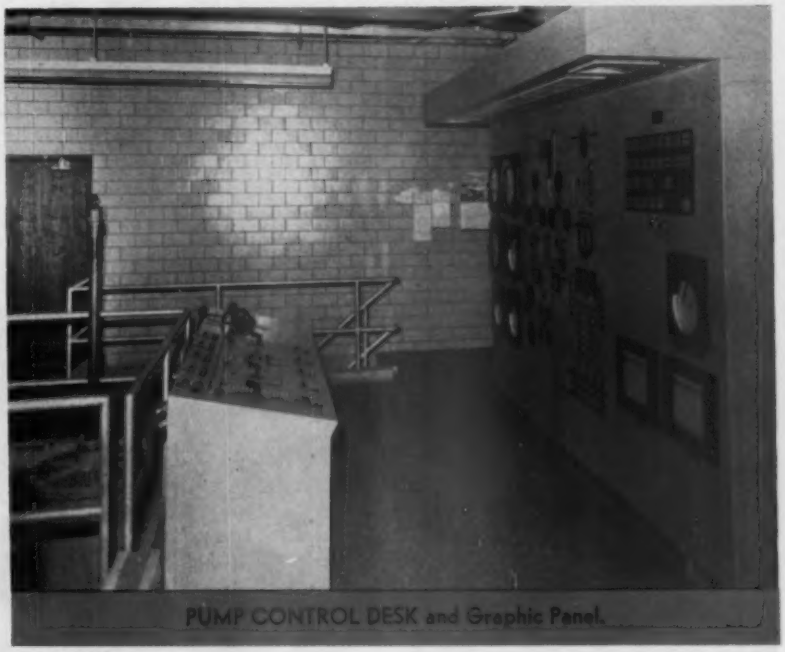
The design of the plant began in 1955, and the digestion units, Figure 1, were placed in operation in December, 1959. These new units were used with the existing plant until the second phase of the new plant, the flow units, were placed in operation in September 1960. The third phase designated as the Effluent and Chemical (E & C) Building was placed in operation in the Spring of 1961.

Diversion Chamber

The diversion chamber is the first structure in the treatment plant. It receives raw sewage from the old 90 in. main interceptor and the 50 in. Harbor Brook Interceptor, and the West Side and Liverpool force mains. The chamber is provided with overflow weirs, three 60 in. by 60 in. bypass sluice gates, and one 96 in. diameter sluice gate, for shutting off flow to the plant. Provisions have been made to chlorinate bypassed sewage.

The water level in the diversion chamber is telemetered to a graphic panel in the Administration (Ad) Building.

The S & G building houses three channels, each with a hand cleaned



PUMP CONTROL DESK and Graphic Panel.

All sluice gates are motorized, and provided with automatic standby power. The gates can be remotely controlled from the control room in the adjoining Screenings and Grit (S & G) Building.

trash rack, a mechanically cleaned bar screen, and a spiral flow aerated grit chamber. Facilities for removing the screenings and grit to trucks for transfer to the points of final disposal are also included.

The 7.5 ft wide vertical back cleaned screens are automatic in operation, with collected screenings being discharged into containers for trucking to the existing Ley Creek treatment plant for incineration.

Each of the three grit chambers is 40 ft, 3-in. long, 13 ft 3-in. wide with a maximum flow depth of 12 ft 5-in. With one channel in operation at the design average flow of 50 mgd, detention time is 1.3 min. Air is supplied through porous tubes on swing diffusers, and the grit is collected and elevated by a V-bucket collector. Because of the expected heavy grit load, each collector is designed to pull through a 24 in. accumulation of grit in the bottom of the channel, and is equipped with a four speed drive.

Spiral flow in the grit channels and air agitation are designed to provide adequate separation of organic and inorganic materials, and no grit washing facilities have been provided.

Each of the three channels is equipped with a 48 in. by 96 in. motorized influent shut off gate and with stop planks for shutting off the flow at the effluent end.

Four 160 cfm positive displacement blowers for the aerated chambers are located in a separate blower

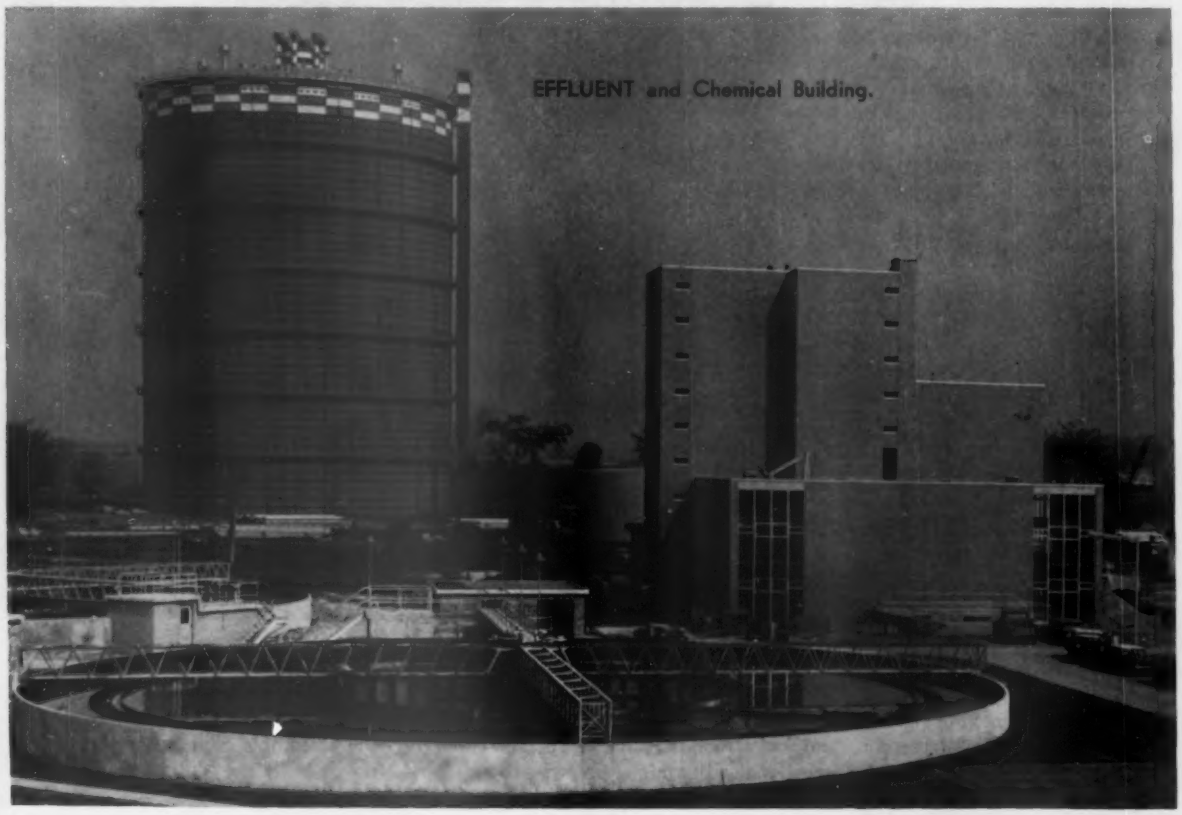
room. This room also contains the main heating and ventilating equipment and the stand-by power generator set for the remote operation of sluice gates in the diversion chamber. Another separate control room contains facilities for push-button control of all equipment in the building.

All electrical work in the S & G building, except in the control and the blower room, is of explosion-proof construction. Because of the combined sewer system in the city, it is not unusual to encounter quantities of gasoline or volatile oils in the raw sewage flow which, may create hazardous atmospheres. All main electrical control equipment is located in the control room.

Administration Building

The Ad building houses the low lift pumping station and an administrative area. The pumping station wet well is attached to, and is a part of the building.

The wet well is divided into three chambers, each with shut-off sluice gates to permit maintenance of the pumps, without taking the station out of operation. Each pump has an intake consisting of a formed horizontal concrete tunnel at the end of which there is a cast iron 54 in. by 42 in. reducing long radius elbow.



There are five vertical centrifugal pumping units, four of which have 42 in. suction and discharge connections, and the fifth a 30 in. suction and a 24 in. discharge connection. Each of the four of the larger pumps has a rated capacity of 70 mgd, when running alone, and the smaller pump is rated at 23 mgd. Two pumps are driven by variable speed wound rotor motors, and the remaining three pumps are driven by constant speed squirrel cage motors.

The normal sanitary flow can be handled by either one of the two variable speed units, with automatic speed regulation as a function of water level in the wet well. Pump discharge piping is of steel, and each one contains a butterfly valve. These valves operate as check valves, from the start or stop pushbuttons of the pumps.

A 10 ton crane has been provided in the pump room for use in servicing the pumps. All high voltage and primary controls are located on the operating floor with the exception of the secondary controls for the variable speed units which are located on the mezzanine above the operating floor.

All normal operating facilities for the sewage pumps have been included as part of the pump control desk which includes a graphic representation of the control process. The panel provides the operator with up-to-date information on the process flow throughout the treatment plant, and includes 54 annunciators to indicate dangerous conditions or malfunctioning of equipment throughout the plant. A horn sounds when an annunciator is tripped.

Process

As sewage enters the diversion chamber, the level is indicated on a strip indicator built into the diversion chamber symbol which will alert the operator of any overflow that may occur.

As the sewage flows into the S & G building and into the low lift pumping station, push-buttons and indicating lights provide means of adjustment and proper channeling of the flow.

Strip indicators are provided for the Venturi meters, with remote control push-buttons and position indicators for the two cone valves located downstream of the Venturi meters. Balance of flow into the two groups of tanks is maintained with finger tip control. The quantity of sludge being pumped from the settling tanks is metered by two magnetic flow meters and transmitted to strip indicators.

The recorders on each side of the panel monitor the flow of the raw sludge, raw sewage, the level in the diversion chamber and low lift wet well, with totalizing recording instruments for the two individual raw sewage and sludge flows. The pressure of both the low pressure and high pressure gas in the gas compression station is telemetered to the panel and these are indicated on panel mounted gauges.

In addition to the annunciators, there are two strip recorders connected to the gas detection devices in the sludge control building and the gas compression station.

The air-conditioned administration area includes a reception room, conference room, general office, directors office, lavatories and storage on the first floor; and the laboratory, locker room, plant superintendent's office, drafting room, showers and toilets on the second floor. The boiler-air-conditioning plant and accumulator water equipment are located in the basement beneath the administration area.

Galleries

Piping and personnel galleries connect the Ad building with the Chemical building, the flow control structures and the sludge digestion control house. The galleries carry the process piping and all main electrical, telemetering and intercommunication services.

Equipment located in the galleries includes two Venturi meters, one in each of the two flow control structure galleries. Each of the 48 in. by 30 in. Venturi meters is provided with a 30 in. motorized cone valve downstream of the throat to not only balance the flow to each of the two flow control structures but also to permit shut-off of the flow when desired. The cone valves are provided with remote control circuits and position indicating devices located in the graphic panel in the Ad building so flow balancing can be done by one operator at the graphic panel.

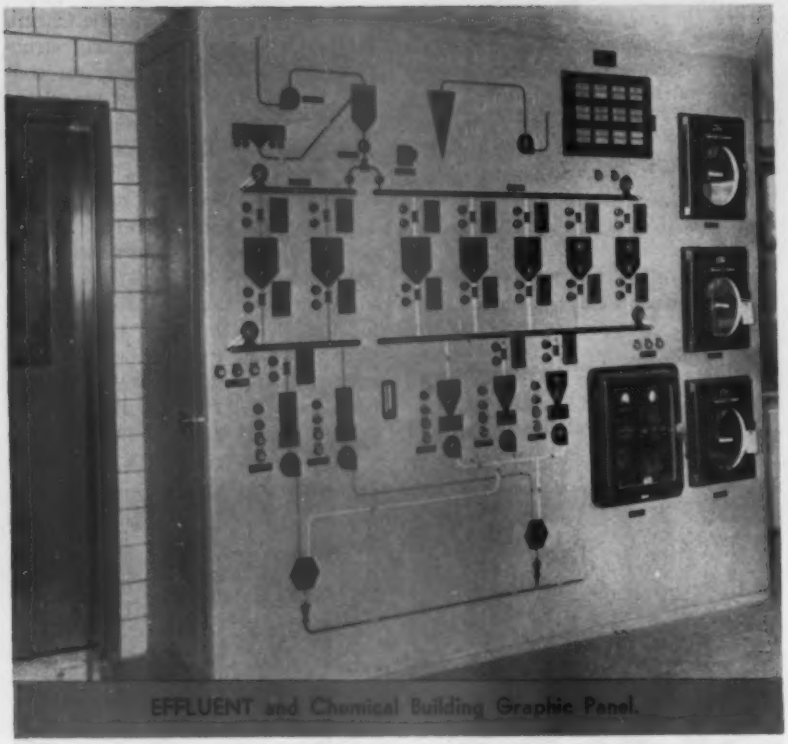
VIEW OF CHEMICAL FEEDER ROOM. Shown are belt gravimetric feeders and slakers for quicklime and ferric sulfate. Pumps and float tanks

The galleries are ventilated by fans in the flow control structures and the digestion tank control house with the air flowing from the Ad building and the Chemical building towards the flow control structures and the control house.

Flow Control Structures

The two flow control structures include rapid mix tanks for rapid mixing of chemicals with the sewage flow, and sludge pumping facilities for pumping of sludge from the settling tanks to the sludge digestion tanks.

The rapid mixing tanks are in the upper part of the structures and each



EFFLUENT and Chemical Building Graphic Panel.

is equipped with a motor driven, turbine type mixer with a theoretical displacement capacity of 17,500 gpm at 68 rpm. The sewage flow enters the bottom of the mixing tanks and discharges over the weirs. Chemicals are added to the sewage flow in the pipe riser before it enters the bottom of the tank. After flowing over the mixing tank weirs, the flow is distributed to the settling tanks.

Sludge pumping facilities are located in the lower part of the structures. Visual sludge wells with telescoping valves are provided. Two positive displacement and one shredding impeller centrifugal sludge pump are used in each control structure. All pumps are rated at 120 gpm and are equipped with variable speed drives.

Controls are so arranged that the sludge pumping operation can be entirely controlled from the visual sludge wells at the top of the structures.

Settling Tanks

Each of the six reinforced concrete settling tanks has a flocculation compartment and a settling compartment, and is provided with scum removal and scum pumping facilities. The tanks have pre-stressed concrete walls and are 122 ft in diameter with a 10 ft 6 in. side water depth. The fiberglass flocculation compartments are 55 ft in diameter with a side water depth of approximately 8 ft. The variable speed rotating flocculation paddles and the collector arms are driven independently from drive mechanisms at the centers of the tanks.

Each sludge collector is equipped with scum rakes which collect the scum and deposit it in a scum trough which in turn discharges into the scum pump suction well. From there, the 40 gpm tubular scum pumps pump the scum either to the sludge digestion tanks or to trucks. When pumped to trucks, the scum is transported to the Ley Creek Treatment Plant for incineration.

Overflow weirs consist of a peripheral weir trough around the outside of the tank and a 104 ft diameter annular weir trough mounted on haunches. The effluent from the settling tanks flows to the wet well of the E & C building, and thence to an effluent channel which is connected to the twin 60 in. conduits which were the outfall conduits for the original treatment plant. During the chlorination season, the effluent is diverted to the old plant settling tanks which have been converted to post-chlorination contact tanks.

INTERIOR VIEW of Sludge Diges-

Effluent and Chemical Building

It was recommended that the effluent from the sewage treatment plant be pumped around Onondaga Lake to the Seneca River. The plans for the Metropolitan plant included an E & C building, with space for two engine driven pumps to pump the effluent to the river, and the chemical handling and feeding facilities. In addition, the plans were completed for an effluent force main. This force main was designed to receive the effluent not only from the Metropolitan plant, but also the Ley Creek treatment plant which serves an area north and east of the city.

Upon completion of the plans for the effluent pumping facilities, the commission requested permission to delay construction until the new treatment units were in full operation, in order to determine the effect of the effluent on the Lake. This permission was granted and the commission has been given one year following the start of full operation of the new units to complete its study.

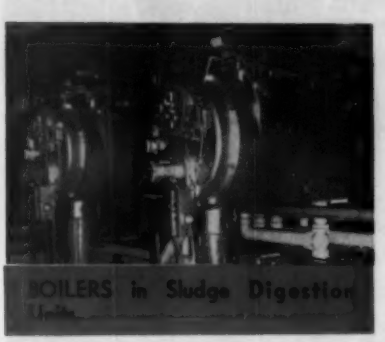
Because of this, the E & C building was constructed with space for the engine driven pumps, but neither the pumps nor the force main have been put under contract.

Chemical Handling

Unslaked lime and ferric sulphate will be purchased in bulk form and stored in bunkers. The total storage on the third floor of the E & C building will provide for 165 tons of lime and 77 tons of ferric sulphate. These chemicals will be conveyed from railroad cars to the bunkers by means of a 5 ton per hr, remotely controlled, pneumatic conveying system and screw conveyors, and

will then be distributed by screw conveyors from the bunkers to the chemical feeder day hoppers. There are two volumetric ferric sulphate feeders and three gravimetric lime feeders and slakers. The lime and ferric sulphate solutions will be pumped from the feed machines to the rapid mixing tanks in the flow control structures.

Chlorine will be purchased in tank cars and fed in solution to the prechlorination diffusers in the S & G building, to the post-chlorination diffusers in the effluent wet well, and to the existing bypass chamber located downstream of the diversion chamber. Flexibility is provided so that any of the feed machines can be connected to any of the feed points. Each of the chlorine feed machines is rated at 8,000 lb. per 24 hr. An electric evaporator is provided for each machine.



BOILERS in Sludge Digestion

Several of the operations which normally are done in a predetermined sequence have been partly automated. For example, manual starting of the ferric sulphate feeder will provide automatic starting of the proper mixer, solution feed pump, vibrator, and will energize the proper solution solenoid valve. All automatic sequences are provided with indicating lights, which warn the operator in the event of improper completion of the sequence.

Rate of flow meters for the chlorine solution and rate of flow repeater instruments for the rate of flow of sewage through the Venturi meters located in the control galleries have been provided in the graphic panel. The latter meters permit the operator to adjust the rate of chemical flow to correspond to the sewage flow.

Sludge Digestion Units

The sludge digestion units include three primary digestion tanks, one secondary gas holder tank, and a control house which contains most of the machinery and equipment required for the operation of the units.

The three primary tanks have three internal mechanical 9,000 gpm mixers for maintaining circulation of the sludge being digested. The control house piping is so arranged that sludge can be recirculated from each tank through heat exchanging equipment and back to the same tank, or can be transferred from any tank to any other tank. The three primary tanks are of reinforced concrete construction with prestressed cylindrical walls and reinforced concrete domes. The gas holder tank has prestressed concrete cylinder walls and a steel floating cover. Each tank is 100 ft in diameter, with a sidewater depth of 27 ft 6 in. in the primary tanks and 24 ft 6 in. in the secondary tank.

The control house and the tanks are connected by underground and overhead piping. The overhead piping is suspended from steel walkway bridges and insulated for protection against freezing.

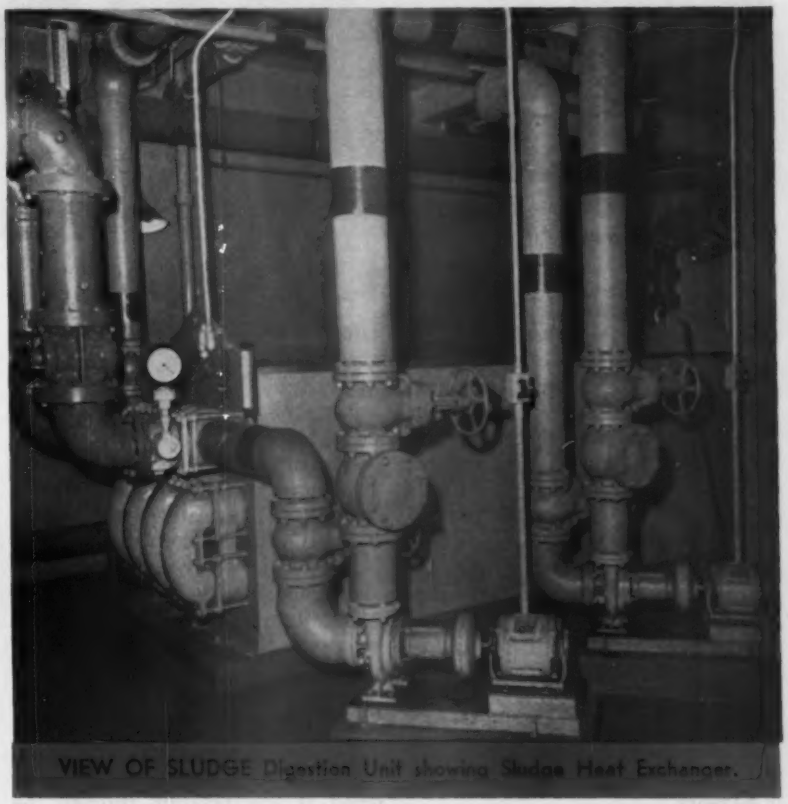
The control house is octagonal in shape and has equipment located on all three floors. The basement contains the tubular heat exchangers, sludge and hot water circulating pumps, sludge pumping equipment and piping. The first floor contains the two boilers, main electrical equipment, gas detection equipment, and the metering equipment. The second floor contains most of the gas handling equipment, and the freeze-up protection system for the exposed outdoor piping.

A penthouse located above the second floor contains the main heating and ventilating equipment.

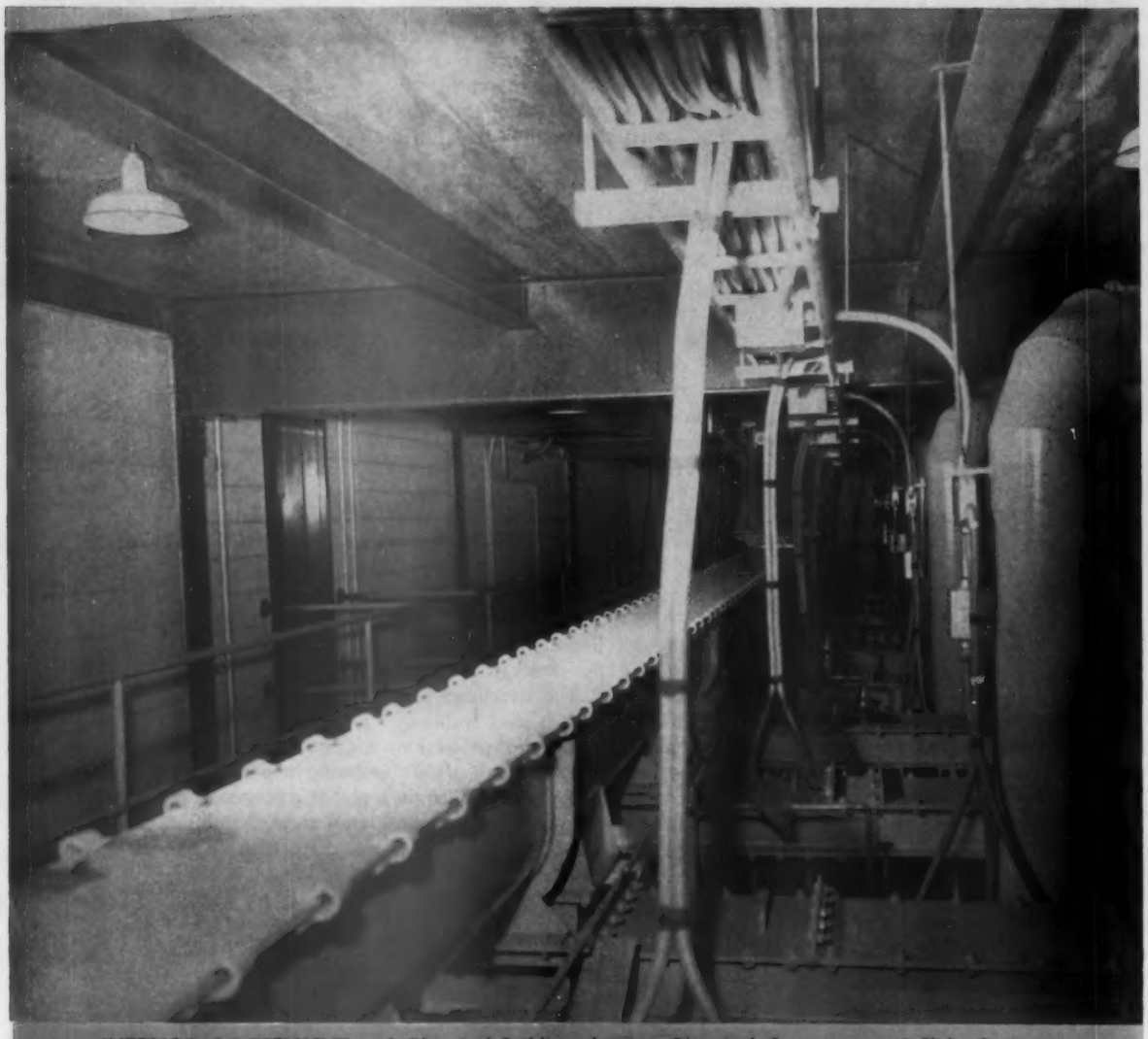
A Feature

The unusual feature of this installation is the gas detection apparatus which has a triple function of detecting a hazardous atmosphere, of sounding a remote alarm in the Ad building, and of interrupting normal electrical power supply to the control house. All of the electrical controls for process equipment are of standard construction.

The controls further provide, following a power interruption, a supply of emergency power for the operation of exit lights and additional



VIEW OF SLUDGE Digestion Unit showing Sludge Heat Exchanger.



INTERIOR OF EFFLUENT and Chemical Building showing Chemical Conveyors and Slide Gates.

ventilation equipment. These are all of explosion-proof construction and can be used for gas elimination in a short time. The normal and emergency ventilation equipment together can exhaust air from the building at the rate of 12 air changes per hr.

Following digestion, sludge is pumped to the waste alkali beds of the Solvay Process Co. located along the west shore of the lake. This method of disposal results in a large saving in capital and operating cost and is of considerable benefit in reclaiming these beds for park or other uses. It is interesting to note that all the raw sludge from the old plant was successfully disposed of in silt trenches in these waste beds for nearly 40 years.

Gas generated in the digestion tanks is processed through moisture separators, meters and flame arrestors before being burned in the two boilers located in the control house. Low or high pressure steam generated in the boilers is used for space heating and for heating of sludge in the digestion tanks. The heating system which has been provided consists of tubular heat exchangers, with hot water on the input side, the hot water being obtained by condensing steam in a heat exchanger.

Gas Compression Station

The excess sludge gas which cannot be used in the control house is piped at low pressure through the galleries to a gas compression station which has two 140 cfm reciprocating compressors capable of raising gas pressure to about 40 psi. The gas compression station serves the dual purpose as a source of suitable fuel for the future dual fuel engines, and also, through a pressure reducing station, as a source of fuel for the boilers in the E & C building and in the Ad building.

The gas compression station is fully automatic in operation and has been so arranged that a number of dangerous conditions arising from a malfunction of equipment are indicated on the graphic panel in the Ad building.

Operation of the plant is under the supervision of Mr. Uhl T. Mann,

director of sewage plant operations and Mr. John J. Hennigan, senior engineer, with Allen Piontkowski as assistant superintendent and Cyrenius Wilson as chemist. There are 40 operators, assistant operators and laborers.

Major Equipment:

Air Blowers—Sutorbilt Corp.
Air Compressors—Worthington Corp. and Ingersol-Rand
Air Diffusers—Chicago Pump Co.
Boilers in Sludge Digestion Units—Cleaver Brooks
Butterfly Valves—Allis-Chalmers Mfg. Co.
Centrifugal Raw Sludge Pumps—Chicago Pump Co.
Chemical Feeders—B-I-F Industries
Chemical Solution Pumps—Komline Sanderson and Jabsco Pump Co.
Chlorination Equipment—Wallace & Tiernan and Yeomans Bros. Co.
Circulating Sludge Pumps—Chicago Pump Co.
Cone Valves—Allis-Chalmers Mfg. Co.
Cranes—Shepard Niles and Cleveland Tramrail
Digested Sludge Pumps—R. B. Carter Co.
Digestion Tank Mixers—Dorr-Oliver, Inc.
Emergency Generator—D. W. Onan & Sons
Fabricated Steel Piping—Morgan Steel Products Co.
Flash Mixing Equipment—Dorr-Oliver, Inc.
Flocculation & Collection Equipment—Dorr-Oliver, Inc.
Gas Compression Equipment—Worthington Corp.
Gas Control Equipment—Pacific Flush Tank Co.
Gas Detection Equipment—Mine Safety Appliances
Gas Meters—Roots-Connersville
Graphic Panel-Ad and E & C Bldgs.—Foxboro Co. and Panellit, Inc.
Laboratory Furniture—Hamilton Mfg. Co.
Large Gate Valves—Ludlow Valve Mfg. Co.
Magnetic Sludge Meters—Foxboro Co.
Main Electrical Equipment—General Electric and Federal Pacific Co.
Main Raw Sewage Pump Motors—General Electric
Main Raw Sewage Pumps—Morris Machine Works
Mechanical Chemical Handling Equipment—Link Belt Co.
Mechanical Grit Collectors—Walker Process Equipment Co.
Mechanical Screens—Walker Process Equipment Co.
Plant Water Pumps—Aurora Pump Co. and Peerless Pump Co.
Plug Valves—Homestead Valve Mfg. Co. and WKM Division, ACF-Industries
Pneumatic Chemical Handling Equipment—Dracco Division, Fuller Co.
Reciprocating Raw Sludge Pumps—Marlow Pump Div. of Bell & Gossett Co.
Scum Pumps—Robbins & Myers, Inc.
Sludge Heat Exchangers—R. B. Carter Co.
Sluice Gates—Rodney Hunt Machine Co.
Sump Pumps—Chicago Pump Co. and Yeomans Bros. Co.
Telescoping Valves—Jeffrey Mfg. Co.
Timber Gates—Rodney Hunt Machine Co.
Venturi Meters—Penn Instrument Div. Burgess Manning Co.
Water Softening Equipment—Hungerford Terry

Officers of N. J. Section AWWA

The New Jersey Section of the AWWA elected 1961-1962 officers from their 580 members.

New chairman will be Gordon L. E. Linn, general manager of the Duhernal Water System at Parlin. Vice-chairman will be Harold L. Gunther, chief engineer of the North Jersey District Water Supply Commission of Wanaque, N. J.

Charles G. Bourgin, general manager of the East Orange Water Department was elected for a three-year term as national director to AWWA.

A. J. Greco, N. J. divisional manager of Americal Water Works Service Co. of Palmyra, N. J. was elected to a two-year term as trustee. Albert F. Pleibel, Maplewood, was elected secretary-treasurer for the 6th time.

Drill In The Everglades?

How do you get a 15-ton blast hole drill to put down holes in the Everglades?

This problem faced contractors Reynolds & Smith, of Morehaven, Fla., who have to construct two levees there. The job is one of building two levees to impound water, one 27 mi. long, the other 11, in muck covered with from 20 in. to 10 ft of water.

Construction involves drilling five-in. blast holes through the decomposed vegetation lying beneath the water, blasting, then using a dragline to dredge out blasted material to form the canal and levee.

The contractors bought a 30-AW Speedstar designed for both air and rotary gun operations. The rig was mounted on a carrier with walkways and two pontoons, five ft deep and wide and 25 ft long.

A crawler track system, with five-ft wide steel shoes linked together, was fashioned to move around each pontoon. The system is driven by an auxiliary engine mounted on the front of the carrier, through a sprocket and chain arrangement.

Rain Infiltration Report

The infiltration rate of rainwater into soil and the construction, installation and operation of infiltrometers are discussed in a Geological Survey report, "A Field Method for Measurement of Infiltration."

The report will be published as a Geological Survey water-supply paper.

Trees Affect Stream Flow

Hydrologists are studying the effect of reforestation on stream flow in New York State.

Information obtained by Geological Survey hydrologists show that 25 years after deforested slopes were replanted to evergreens, total runoff in streams in three study areas was reduced by 0.36 in. per year, and peak discharges during the dormant season were reduced by 66 percent.

Now significant changes were found in peak discharges during the growing season, or in rates of baseflow recession, volumes of direct runoff or annual low flow, the Department of the Interior reported.

Geological Survey Water-Supply Paper 1602, "Effect of Reforestation of Streamflow in Central New York" by William J. Schneider and Gordon R. Ayer, is available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for 45 cents.

Operating Experiences with Natural and Forced Convection . . .

SOLAR STILLS

by WERNER N. GRUNE, ROSS B. HUGHES and T. LEWIS THOMPSON
Professor of Sanitary Engineering and Graduate Research Assistants
School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia

■ This report describes several new designs of solar distillers which are under study to increase fresh water production and to improve process economy. The experiments are being conducted on the Georgia Institute of Technology campus, Atlanta, Georgia, latitude 33° 46′ 25″ north. The 1960 experimental period extended from April 15, 1960 to November 7, 1960.

A conventional solar still, although simple in design and operation, produces only a small amount of water per unit of area and, therefore, cannot compete economically with other desalting processes. The low efficiency is due to the dispersed form of energy of the sun and the inherent properties of the design. In a natural convection still, a mass of water is placed in a black absorbing basin covered with a material which is relatively impermeable to the infrared and longer wave lengths, but which allows the higher temperature spectrum to pass through. Short wave lengths are absorbed by vapor in the air space and by the black bottom of the basin, and reradiated as long wave radiation which heats the water and air in the still. The water is converted into vapor which is transferred by diffusion and convection to the cover. There it condenses, releasing its heat to the ambient air. The condensate runs down the cover and is collected by gutters.

The natural convection solar still combines all three basic processes in one unit; the collection of solar energy, evaporation and condensation. This type relies on natural convection within the still and heat rejection from the cover by radiation and convection for production.

To permit continuous operation from an intermittent energy source, solar stills with a deep brine layer, which provides a higher thermal capacity, are able to operate during the hours when no solar energy is received by the basin.

Forced convection stills were designed to study the effect of the following operating principles on production:

1. Use of air as intermediate medium by substituting forced convection for natural convection to increase evaporation of the brine.

2. Circulating the air-vapor mixture from a simple still to an external water-cooled condenser to gain efficiency from a lower condensing temperature.

3. Recovery of energy by exchange with entering sea water in an external exchanger while extracting condensate from saturated vapor.

4. Substitution of droplet evaporation for flat sheet evaporation to increase the interfacial area between the air and brine.

Table I

Characteristics and Properties of Solar Stills.

Still Designation	Type of Still	Roof Details	Net Effective Area (sq ft)	Mass of Water @ 70°F (lbs)
I	Deep basin; natural convection; Mylar; 12 in. water depth (DNM)	Mylar Type W 30° angle	9.08	573
II	Shallow basin; natural convection; Mylar; 2 in. water depth (SFM)	Mylar Type W 30° angle	9.08	83
III or	Shallow basin; natural convection; Teslar; 2 in. water depth (SNT)	Teslar Type 20A 45° angle	9.08	71
III	Shallow basin; natural convection; Mylar; 2 in. water depth (SNM)	Mylar Type W 30° angle	9.08	71
IV	Deep basin; forced convection; Mylar; 12 in. water depth (DFM)	Mylar Type W 30° angle	9.08	661
V	Shallow basin; natural convection; glass; 2 in. water depth (SNG)	Sheet glass 30° angle	9.08	71
VI	Deep basin; forced convection; Teslar; 12 in. water depth (DFT)	Teslar Type 20A 30° angle	61.1	3,133

5. Return of air from the heat exchanger to provide saturated air to the still.

The following types of glazings were employed; Mylar (Type W), Teslar and glass. Further simplification of the design has been achieved by eliminating collecting gutters in shallow basin units.

Experimental Equipment

During the summer of 1960 a total of six stills were evaluated. Five of these were of varied designs, each with a solar collection area of 9 sq ft, with Mylar, Teslar and glass canopies. The sixth still was a 61 sq ft, deep basin, forced convection still, with a Teslar cover. Table 1 summarizes details of the salient characteristics and features of these stills.

Auxiliary Systems for Forced Convection Stills

All stills have a float valve to maintain a constant water level and are equipped with inclined manometers which allow the water basin depth to be read accurately. All heat exchangers, blowers and flowmeters were operational throughout the summer of 1960. Identical blowers and flowmeters were used for forced convection stills II (SFM) and IV (DFM). A Dayton Blower[1] forces air into the still through a Flowrator meter[2]. The blower is a ⅛ hp, centrifugal-fan type. The Flowrator meter has a capacity of 10.4 cfm under standard conditions.

Two relative humidity cells are built into the air piping, one ahead and the other at the exit of each still.

Identical heat exchangers[3] are used on Stills IV (DMF) and VI (DFT). The outside case of these heat exchangers is completely insulated with rockwool and wrapped with 1½ mill polyethylene. Thermocouple probes are located in the water and air streams entering and exiting the exchanger.

Instrumentation and Sensing Elements

Siphonic Flowcell and Recorder. A continous, 24-hour recording system to measure distillate production was developed. The final model of the flowcell is shown in Figure 1. The cell consists of a cylindrical glass body with two tubes entering the top and a third tube extending from the bottom to form a siphon arm. Two platinum electrodes are sealed into the sides of the cell. These electrodes are folded back 180 deg. to increase cell sensitivity. The siphon arm is provided with a 12 mm diameter bubble to yield a reproducible volume during each siphon cycle. Periodic checks with clean flowcells for ten consecutive trials have shown a reproducible volume per siphon with a maximum deviation of less than one percent. Over a 24-hour period, while production varies from zero to a maximum rate, the absolute siphon volume varies up to seven percent.

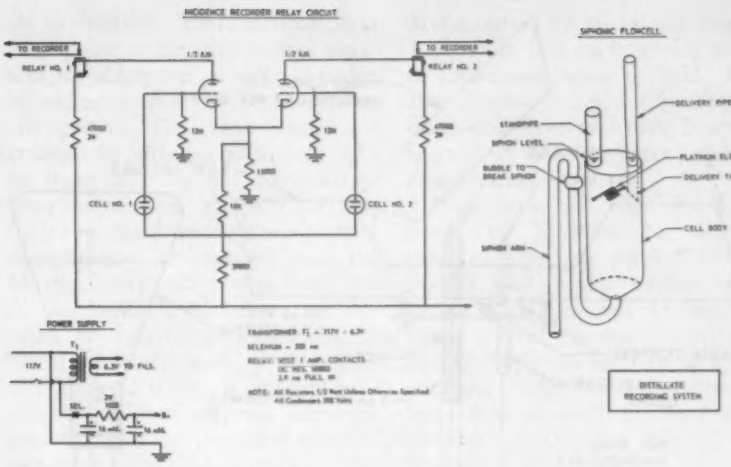


FIG. 1. SIPHONIC FLOW CELL and Associated Circuitry.

To register a pulse for each flowcell siphon cycle, an incidence recorder[4] was modified to incorporate the relay circuitry. The relay circuit shown in Figure 1, associated with the recorder, is a simple triode amplifier with a plate relay. The circuit is activated by distillate making contact between the flowcell electrodes. The plate relay in the amplifier circuit actuates the electromagnet which pulls the pen over and puts a pip on the chart paper. The record of pips versus time, combined with a flowcell calibration, gives the production rate.

Instrumentation for Solar Radiation Measurement. A continuous record of the solar radiation intensity is obtained with a 50 junction Eppley Pyrheliometer[5] and a 0 to 20 mv recorder[6]. The pyrheliometer is located 6 in. above the adjacent surfaces. The solar radiation was determined for each day by planimetering the area under the recorded curve and converted from mv/cal/(cm²) (min) to BTU/sq ft/day.

Relative Humidity Cells. Investigations into available humidity measuring devices showed that they would not accurately record in the 95 to 100 percent relative humidity range at temperatures above 150°F.

The adopted relative humidity cell design is shown in Figure 2. Both wet and dry bulb thermocouples were inserted through glass tubing to insulate the wick and thermocouple from the air piping. The cell was calibrated against a sling-type psychrometer[7] to verify its accuracy.

Canopy Temperature Measurements. Canopy temperature measurements on the stills were needed to determine the heat gained or lost through the various types of cover materials. Forty gauge, copper-constantan thermocouple wire was chosen for these measurements. The small size of this junction minimizes the heat picked up by absorption and

[1] Type 1-C982 Dayton Blower, manufactured by Dayton Electric Mfg. Co., Chicago, Ill.

[2] Flowrator meter, Series 1700, manufactured by Fischer & Porter Co., Warminster, Penna.

[3] American Blower Corporation, Division of American Radiator and Standard Sanitary Corp., Detroit, Mich.

[4] The chart mechanism is taken from a Rustrak recorder, manufactured by the Rust Industrial Co., Inc., 180 Silver Street, Manchester, N. H.

[5] Eppley Pyrheliometer, 180° Weather Bureau type, Serial No. 3790, Model 50 junction, calibration 8 mv/cal/cm²/min, manufactured by the Eppley Laboratory, Inc., 2 Scientific Avenue, Newport, R. I.

[6] Series 8000, Single Point Recorder Controller, Range 0-20 mv, manufactured by the Barber-Colman Company, Wheelco Instrument Division, Rockford, Ill.

[7] Bacharach Sling Psychrometer, Model SAC, manufactured by Bacharach Industrial Instrument Company, 7301 Penn Avenue, Pittsburgh 8, Penna.

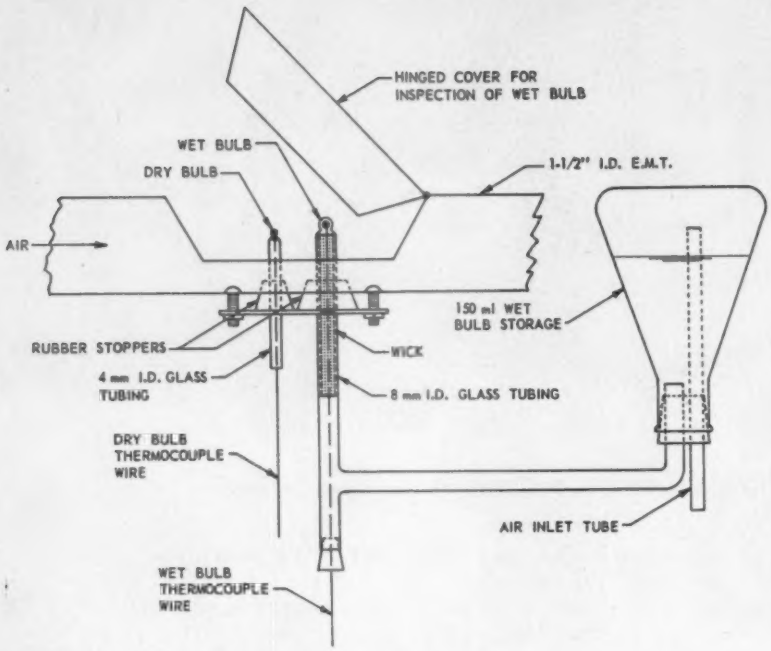


FIG. 2. RELATIVE HUMIDITY CELL in detail.

measures the temperature of a very thin film. The best physical bond was obtained by sandwiching the thermocouple to the canopy with a one sq cm patch of five mil Mylar, Type W, and Goodyear Cement No. A916B. Two thermocouples spaced ¾ in. apart had a maximum temperature deviation of 3°F.

Evaluation Of Still Performance

Following the discussion of cumulative daily production from all stills, the presentation will be divided into two major groups:

A. Natural convection stills.
B. Forced convection stills.

In all subsequent discussions of still production/unit area (sq ft), reference is made to the horizontal water basin surface area, unless stated otherwise.

Discussion of Cumulative Daily Production

Figure 3 shows the cumulative daily production from the six stills.

The behavior of Still I (DNM) is typical of deep basin production, starting shortly after sunrise and producing at a substantially constant rate until early afternoon. The maximum rate of production occurs between 8 p.m. and 5 a.m., which may be expected from the enthalpy stored in the brine and the rapid cooling of the cover after sunset. Total 24-hour production from Still I was 0.375 lb/sq ft, of which 0.212 lb/sq ft, or 57 percent was contributed after sunset.

Stills III (SNT) and V (SNG) are identical except for the covers. Still III has a 1.5 mil Teslar canopy, while Still V has a 7/32 inch triple-strength sheet glass cover. Still III started to produce at 7 a.m., whereas Still V continued to operate throughout the night at a very low rate. The difference in production is due to the different water depths in the two basins. Between July 18 and August 9, 1960, some experiments were conducted in Still III to study the effect of water depth on still efficiency. The water depth in Still III on August 4th was approximately one-half the depth in Still V. Therefore, less heat could be stored in the basin of Still III resulting in no distillate production during the early morning hours. The lower water depth in Still III also accounts for its higher operating temperatures. During the peak solar radiation hours, vapor and basin temperatures are from 10 to 15° above those in Still V. The production from both stills reaches a maximum rate of about 0.095 lb/sq ft/hr between 2 and 4 p.m. Total production from Stills III and V is 0.759 lb/sq ft and 0.743 lb/sq ft respectively, on August 4, 1960, the night production accounting for 7 percent and 20 percent from the two stills.

No distillate was collected from Still II (SFM) until 10 AM. No production can be expected until wet bulb temperature of the air entering the heat exchanger exceeds the temperature of the condenser coolant. Total 24—hour production from Still II was 0.788 lb/sq ft with 0.123 lb/sq ft obtained after sunset, or about 16 percent during the night. The production from this unit is low, due to an inadequate flow of air through the still.

Distillate production from Still IV (DFM) is composed of that from the gutters and from the heat exchanger. The relative production from the two sources is a function of the enthalpy of the brine, air flow rate, ambient temperature, rate of flow of cooling water, and its temperature. In Figure 3 the production rate from the gutters is steadily decreasing to a minimum between 7 a.m. and 1 p.m., a period during which the temperature of the cover rises more rapidly than the brine in the deep basin. This temperature gradient reverses itself during the afternoon, resulting in a gradual increase in the production rate. After midnight the rate again decreases. On the other hand, the production rate from the heat exchanger increases throughout the day with the maximum between 5 and 7 PM. Production falls off only slightly between sunset and sunrise, because the blower maintained forced convection on a 24-hour basis. Thus, transfer from the liquid to the vapor phase continued throughout the night[2]. It was found that forced convection on a 24-hour basis improved heat exchanger production, being only slightly detrimental to gutter production. The practice of 24-hour forced convection at the optimum air flow rate resulted in a net increase of 45 percent above that from intermittent operation[3].

Figure 3 shows that production from external condensation on August 4, 1960 was 1.20 lb/sq ft/day, while that from the gutter was 0.31 lb/sq ft/day, or a total production of 1.51 lb/sq ft/day with 72 percent produced at night.

The production characteristics from Still VI (DFT) depart from

those observed with Still IV as a greater percentage of the production from Still VI is collected in the external condenser. The earlier onset of production from the gutters in Still IV as compared with Still VI probably is due to a combination of factors: (1) the different types of plastic covers employed, (2) the difference in relative air flow rates and (3) the dispersion of the brine in Still IV.

The total 24-hour production of Still VI on August 2, 1960, was 1.05 lb/sq ft/day; that from the heat exchanger 0.95 lb/sq ft/day, and that from the gutters 0.10 lb/sq ft/day. About 72 percent of the total production occurred at night, the same ratio observed with Still IV.

Natural Convection Stills

Daily Production versus Solar Radiation

Shallow Basin Stills. Two natural convection shallow basin stills were operated. Still V with a glass cover and Still III with a 1.5 mil Teslar cover, later changed to Mylar.

Originally, Still V was operated with a 45 deg slope glass cover and 1¼ inch wide gutters, later changed to a 30 deg slope canopy with ½ inch gutters. Results from Still IV indicate that the changeover to the 30 deg roof caused a small increase in production. This increase was largely due to the greater area available for absorption of solar radiation by reducing shadow from supports and gutters. The cover change increased the effective area from 7.73 sq ft to 8.72 sq ft. Extrapolating from the equation, at 2,000 BTU/sq ft/day a daily production of 0.44 lb/sq ft may be expected from the 45 deg cover, while that from the 30 deg cover is 0.50 lb/sq ft. The ratio of specific productivities is 0.885, while the ratio of the effective areas is 0.886. It appears reasonable to attribute the increased production to the increased effective area.

Initially, Still III was operated with a loosely fitting 1.5 mil Teslar, 45 deg cover, changed later to 5 mil Mylar on a 30 deg slope. Results indicate that higher production was achieved with the 45 deg Teslar cover. From results on Still VI, a daily production of 0.49 lb/sq ft is predicted at 2,000 BTU/sq ft/day with the 30 deg Mylar cover, while production with the 45 deg Teslar cover would be 0.623 lb/sq ft/day. The higher productivity may be attributed to the larger condensing area rather than differences in transmissivity between the two plastics.

The production ratio from the two types of covers was 0.80 at 2,000 BTU/sq ft/day. The canopy area for Mylar was 10.5 sq ft and that for Teslar was 12.9 sq ft, giving a ratio of condensing areas of 0.82. These area differences account for the production differences within 2 percent and appear to be the more important consideration.

Deep Basin Still (Still I). Figure from Still V show the effect of solar radiation on production from Still I with Mylar covers having slopes of 30 deg and 45 deg. The effect of the different cover areas was probably overshadowed by the excessive "edge effect" due to the large ratio of depth to chord (0.91 compared to 0.33 for Still III and V).

Forced Convection Stills

The change in internal efficiency, caused by forced circulation of the air, constitutes the major differences between natural and forced convection stills. Internal efficiency is defined as the ratio of the latent heat of vaporization of the distillate at the condensing surface to the sum of the heat for distillate production plus radiant heat and sensible heat, without considering reflection of solar radiation, transmissivity of the glazing, etc. This efficiency is essentially a comparison of the rates of mass transfer, sensible heat transfer and radiant heat transfer be-

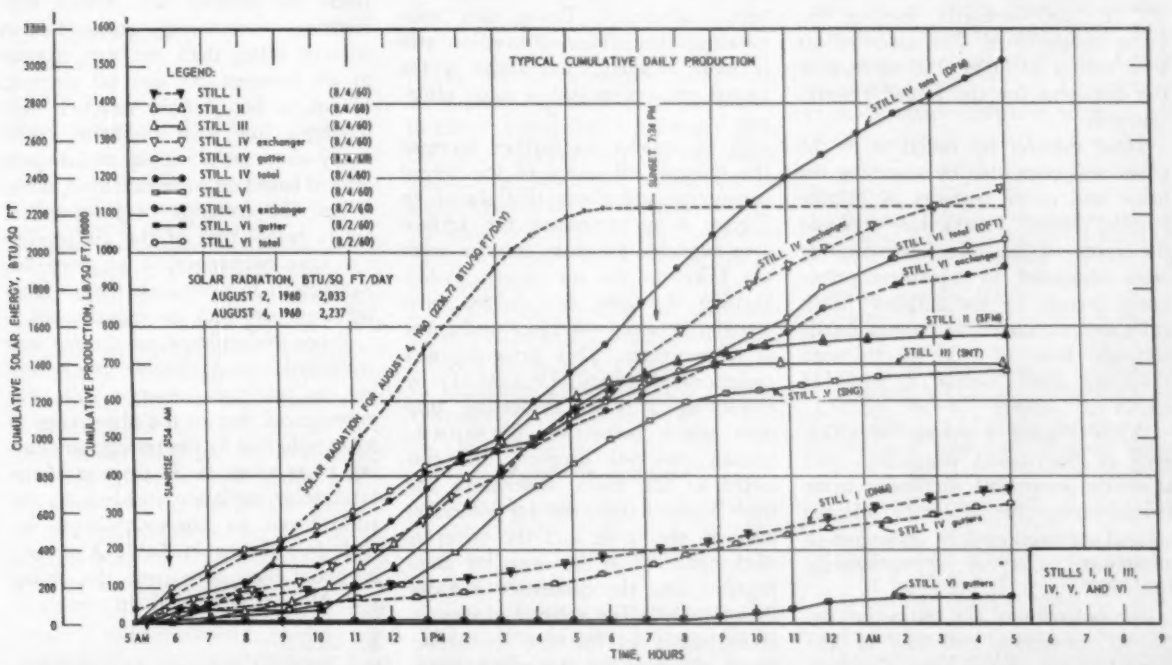


Fig. 3. TYPICAL Cumulative Daily Production Curves.

tween the brine and the condensing surface.

Figure 4 was prepared for natural convection stills by assuming the cover temperature constant at 90° F and varying the brine temperature; for forced convection stills by assuming the cover, saturated air entering the still, and saturated air exiting the heat exchanger constant at 90° F, and similarly varying the brine temperature. The assumed air flow rate is 24 lb/hr/9.08 sq ft, near the optimum for the forced convection still.

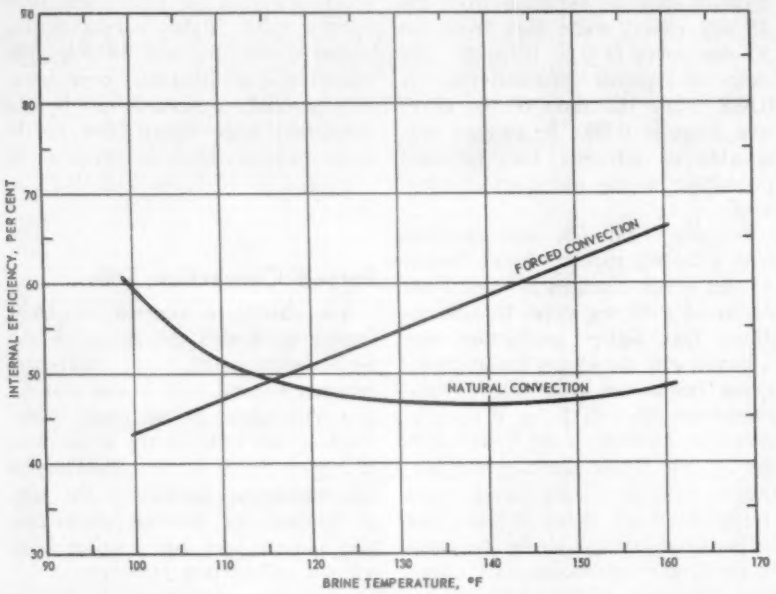


Fig. 4. COMPARISON of the Internal Efficiencies of Forced and Natural Convection Stills.

Heat transfer by radiation to the cover was computed by assuming the brine and cover surfaces as infinite parallel planes[4]. Production rates and the rates of sensible heat transfer were computed by equations previously derived by the authors[5]. Both stills were assumed to have a cross-sectional area of 9.08 sq ft, with a 45 deg cover, similar to Still III (SNT).

While Figure 4 shows the efficiency of the forced convection still as nearly linear with increasing brine temperature, the efficiency of the natural convection still undergoes a minimum value at approximately 140° F.

The behavior of the curve for the natural convection still may be explained by the relative rates of change in the radiation and mass transfer expressions. Radiation from the basin is controlled by the absolute temperature of the brine raised to the fourth power, while mass transfer is related to the partial pressure of water vapor at the brine surface which is a logarithmic function of temperature.

The two efficiency curves cross at about 115° F, or at 49 percent internal efficiency. Below this temperature the natural convection still is more efficient, and above it the forced convection still is more efficient.

It is possible to further increase the internal efficiency of the forced convection still above that shown in Figure 4 by increasing the surface area available for mass transfer from the brine to the air stream, while keeping the area for radiant heat transfer between the brine and cover at a minimum. This principle was incorporated in Still IV (DFM) by employing a water dispersing tray over which brine was pumped, broken into fine droplets, and collected in the basin underneath the tray. Hence, the area for radiation between the brine and the cover is unchanged, while the area for mass transfer into the condenser is more than doubled. The relative change in areas causes an increase in the internal efficiency for this still as demonstrated by the higher specific productivity.

Another advantage of the forced convection still is that energy from the ambient air may be utilized in addition to solar radiation. When the enthalpy of the air entering the still is above that leaving the heat exchanger, energy is added to the system by the air. For example, if the average ambient air temperature during a 24-hour period is 80° F and saturated, while the average temperature of the air leaving the condenser is 65° F and saturated, the difference in humidities is 0.009 lb water/lb dry air. At an air flow rate of 24 lb/hr* the still will "produce" 5.2 lbs of water per day from the air. For a 9.08 sq ft still this represents 0.571 lb/sq ft/day, or the equivalent of nearly 600 BTU/sq ft. This energy, in addition to solar radiation, led to very high specific productivities for Still IV over a period of several weeks, while the still operated near the optimum air flow rate. Results from Still IV, showing the effect of cooling water and air flow rates on efficiency and based entirely on production extracted by the heat exchanger, point to different results near 100 percent efficiency. When distillate collected from the gutters is included, this figure becomes 110 to 120 percent. This apparent efficiency is explained predominantly by moisture extracted from the ambient air. Actual efficiencies, considering gains from sources other than the sun, appear to lie between 50 and 60 percent. Hence, a hot, humid summer day, having a low solar radiation, could easily show an efficiency of 120 percent, if based on solar radiation alone. When the enthalpy of the ambient air is below that of the air leaving the heat exchanger, it is more advantageous to recirculate the air from the condenser back through the still.

When recirculation of the air was employed, using flexible black tubing, an additional energy gain was experienced due to the absorption of solar radiation by the tubing, amounting to as much as 33 percent of the total solar radiation incident to the still. From an energy balance for Still IV, shown in Table 2, it may be noted that gains from the piping and blower amounted to nearly a

* This figure is equivalent to 5.6 cfm, which is near the optimum air flow rate determined experimentally for Still IV.

W&SW FUTURE FEATURES . . .

Manuscripts Scheduled for the Next Issue of WATER & SEWAGE WORKS

Antibacterial Activity of Oscillatoria Formosa Bory Extract

Floyd F. Davidson
Professor of Biology
Baylor University
A Research Progress Report of bacterial death in certain cultures.

A Rapid Method for Analyzing the Performance of a Calcining Kiln

Charles F. Whitcomb, Jr.
San Diego, Calif.
An analytical guide for the water softening sludge reclaiming plant operated by San Diego.

The Meaning of Coliform Results

Gerson Chanin, F. W. Hartmann and M. F. Lollich
Oakland, Calif., and the State Department of Public Health
Emphasis on the importance of an adequate sampling program.

Water Utility Distribution Loss-Part 4

Dale Smelser
Knoxville, Tenn.
The conclusions of the series about water quantity accounting.

third of the total solar radiation. The efficiency of the still on that day is approximately 52 percent based on the total heat input.

Table 2

Total Energy Balance*
Still IV—October 1, 1960

	BTU/sq ft/day	Percent of Solar Radiation
Solar Radiation	+1,611	100
Gain from Piping and Blower	+ 527	+32.7
Sensible Heat	— 62	— 3.9
Heat Exchanger	—1,215	—75.4
Conduction	— 181	—11.2
Convection	— 69	— 4.3
Net Radiation	— 569	—35.3
Unaccounted for	— 41	— 2.6

*(+) denotes incoming energy; (—) denotes outgoing energy

For each of the forced convection stills investigated, an optimum air flow rate was found. This rate is a function of the physical dimensions of the still, the mean density of the air stream and the temperatures involved. Below the optimum air flow rate losses through the still cover become excessive, and above it the heat required for the greater amount of the non-condensables in the air stream becomes excessive. Where no gutters have been provided as in the case of Still II (SFM), the former effect is most important. In this case, condensation not only effects a heat loss, but by droplet formation causes losses due to scattering and reflection.

Production from the gutters of a forced convection still is also greatly affected by the air flow rate for Still IV. In general, no gutter production occurs until the air flow through the still is low enough for the dew point to be reached at the cover. As the air flow is further decreased gutter production increases approaching that from a natural convection still.

Experimentation now in progress involves the use of multiple glazings which is expected to further increase the efficiency of the forced convection stills by reducing energy losses through the cover.

Conclusions

The forced convection still, with its higher efficiency and the ability to extract additional fresh water from the air, appears superior in many respects to the natural convection designs investigated. However, its application is limited to regions where electrical power and cooling water are available.

Further experimentation with multiple glazings and increased brine surface areas is expected to result in increased efficiencies and productivities from these stills.

Acknowledgements

Valuable assistance was rendered by Messrs. L. R. Kirk, G. W. Gibson and J. M. Gutermuth, who aided in data reduction.

The authors wish to express their appreciation for the technical assistance and cooperation from Joseph J. Strobel, Chief, Processes Development Division, L. J. Winchester, Process Engineer, both of the Office of Saline Water. The authors are indebted to Dr. G. O. G. Löf, Consulting Chemical Engineer, for his suggestions and encouragement during the course of these investigations. The authors are also indebted to Douglas E. Dismukes, Manager, Water and Waste Division, and Leo J. Carroll, Product Application Engineer, of Fischer and Porter Company, to John H. Williamson of Industrial Instruments, Inc., and Frank Mascitti of the Brown Instrument Division of Minneapolis-Honeywell Regulator Company for their splendid cooperation to make the necessary instruments available, their technical advice and service in connection with these investigations. This program is sponsored by the Office of Saline Water, U. S. Department of the Interior, research contract 14-01-001-178.

References

1. National Physical Laboratory, *Measurement of Humidity,* Department of Scientific and Industrial Research, p. 5, par. 4 and p. 12, 3rd Ed., H. M. S. Office, London (1958).
2. Grune, W. N., *Development of an Improvement Solar Still,* Progress Report No. 3 to the Office of Saline Water, U. S. Department of the Interior, Washington 25, D. C. (May 1960).
3. Grune, W. N., Hughes, R. B. and Thompson, T. L., *Development of an Improved Solar Still,* Progress Report Nos. 4 and 5 to the Office of Saline Water, U. S. Department of the Interior, Washington 25, D. C. (Nov. 1960).
4. McAdams, W. H., *Heat Transmission,* McGraw-Hill Book Co., Inc., 3rd Ed., New York, New York (1954).
5. Grune, W. N., Thompson, T. L. and Collins, R. A., *New Applications of Thermodynamic Principles to Solar Distillation,* presented at the Summer Annual Meeting, A.S.M.E., Los Angeles, California (June 11-16, 1961).

Water sampling and comparative analysis for Coliforms permit a critical examination of the . . .

Multiple-tube Dilution and Membrane Filter Methods

by W. L. MALLMANN and FRANK R. PEABODY
Dept. of Microbiology and Public Health
Mich. State University
East Lansing, Michigan

EDITOR'S NOTE: The Eleventh Edition of *Standard Methods* provides water and wastewater technicians with a dual standard applicable to coliform organism detection and enumeration. The standard as written was accepted only after considerable discussion and with reservation by some. Data are presented here which ought to stimulate discussion among analysts. Further research must be encouraged and aimed at evolving techniques by means of which sampling and parallel analysis using the two methods would yield comparative results. A Research Progress Report on this subject appeared on these pages recently (W&SW, June 1961, p. 238).

■ THE MEMBRANE FILTER technique (MF) for enumerating coliform organisms in water has been widely tested over the past ten years since the original report by Goetz and Tsunneishi[1] in 1951. The technique has a number of advantages over the multiple-tube dilution (MTD) method which has been standard procedure for testing water throughout the world. The principal advantage of the MF technique is the testing of waters with low coliform organism content (less than 2 per 100 ml). It also has all the advantages of the pour-plate technique which has been a standard procedure for enumerating bacterial populations in milk and foods.

By the use of diagnostic media, such as Endo's medium, the MF technique has made possible a direct count of coliform organisms in water by using large volumes of water for low populations or by dilution procedure for high populations.

The eleventh edition of *Standard Methods for the Examination of Water and Waste Water*[2] states that either the MTD or MF techniques may be used for the enumeration of coliform organisms in water within the limitations specified for each technique. No limitations are placed on either procedure for the examination of potable waters.

Where two methods are included in standard procedures, the Committees responsible for the preparation of the standard procedures must be sure that the results from both tests are equivalent; otherwise, two methods might be in use throughout the country, yielding data not in conformance. Inasmuch as the standard method for enumerating coliform organisms is designed to measure the public health hazard of water, it is essential and mandatory that the sensitivity of the two methods be the same in all waters used for human consumption; either raw water from a protected water shed, or treated water originating from a sewage contaminated source.

Unfortunately, not all members of the American Public Health Association Committee responsible for the preparation of bacteriological standards are in agreement that these two procedures yield comparable results. The senior author, (a member of the above committee) believes that the MF technique does not yield data comparable to the MTD procedure and that further research is necessary to improve the sensitivity of the technique. The authors believe that the sensitivity of the MF technique is particularly poor when testing marginal waters, i.e. waters considered in the potable area. This paper is a presentation of data gathered over the past five years in an extensive study of the MTD and MF techniques.

These studies were initiated as the result of the development of the drop-plate technique for the enumeration of coliform organisms[3] by the writers. The drop-plate technique was developed as a companion procedure to the MF test. The latter test for waters of low coliform population and the former for high coliform populations where dilution of the sample would be necessary for application of MF tests.

Technique Evaluation

To evaluate the drop-plate technique, comparative tests were made by the MTD procedure employing lauryl tryptose broth, using sewage effluents and river waters. In an examination of sewage effluent, 14 tests

Table 1

Comparison of Three Methods for the Quantitative Determination of Coliform Organisms in a Sewage Contaminated River.

Sample No.	Coliforms per 100 ml of sample		
	Drop Plate	MTD	MF
	(10 replicates)**	(5 replicates)*	(10 replicates)**
1	15,200	10,250	10,200
2	9,500	8,170	3,125
3	9,860	9,200	6,900
4	10,800	12,000	7,750
5	9,450	7,100	8,625
6	6,700	4,580	3,930
Geom. Mean Av.	9,730[1]	8,250[2]	6,640[3]

*Each trial consisted of 3 dilutions of 5 tubes each.
**M Endo MF (Difco) used for drop plates and MF tests.
1—Drop plate average represents 250 0.04 ml counts.
2—MTD averages represents 25 5 tube replicate plantings in 3 dilutions.
3—MF averages represent 60 0.02 ml counts.

were made using 9 drop-plate counts for each (126 replicates) and 14 sets of 5 tubes in each of 3 dilutions (70 replicates). The geometric mean was 1,700,000 organisms/100 ml for the drop-plate technique and 920,000 organisms/100 ml for the MDT test. The drop plate technique gave a coliform count (confirmed) 1.84 times greater than that for the MTD procedure. In every set of data gathered, the drop-plate technique gave much higher counts than did the MTD procedure, demonstrating that by laboratory testing, the MTD calculated by either arithmetic or geometric means was less than the actual number of coliform organisms present. The application of a bias correction factor to reduce the MPN's to a true index as reported by Thomas, Woodward and Kabler[4] is unwarranted as the true coliform content of water is considerably higher than the presently reported MPN's.

McCarthy, Thomas and Delaney[5] found in a pure culture study using coliform organisms that the MTD geometric mean was 10% higher than agar pour-plate counts. It has been the authors' experience that pure cultures of coliform organisms in the logarithmic stage of growth always yield higher indices in liquid media than do coliforms found in water that may be in their stationary growth phase. In drop-plate studies, pure cultures gave a 1 to 1 ratio for drop-plates and MTD methods.

The writers have observed over a period of years that the MF technique yields a lower coliform count than that obtained by MTD procedures. This lower count was believed to be due to improper media, so studies were made by McCarthy[6] with some degree of success. Others, such as Hajna and Damon[7] and Fifield and Schaufus[8], McCarthy and Delaney[9] Noble and Reitman[10], Clark, *et al*[11] have proposed media that have yielded greater recovery of coliform organisms. In the hands of the authors, the M Endo MF medium reported by Fifield and Schaufus[8] has been the best to date.

Comparative Studies

A comparative test of media was made with the drop-plate procedure by placing a known amount of contaminated water (.02 ml) on M Endo MF agar and an equal amount on the surface of a membrane filter placed on the surface of M Endo MF agar. Considerable difficulty was encountered in spreading the water over the surface of the membrane. However, after numerous trials, it was found that the number of colonies was approximately the same on the two different surfaces. This would indicate that the drop-plate technique and the membrane filter procedure should yield similar results and that media were not responsible for the lower counts observed in routine use.

Table 1 presents data on a comparative study of the drop-plate, the MTD and the MF techniques. Six samples from the same source were tested. Each sample was replicated 10 times on the drop-plates and membrane filters and the MTD consisted of 6 replicates of 3 dilutions of 5 tubes each. The relationship of the three methods is presented as the geometric mean as follows: the count on the drop-plates was 9730 organisms/100 ml, the MTD 8250 organisms/100 ml and the MF 6640 organisms/100 ml. The water source was a sewage-contaminated river. The averages represent 60 drop-plate counts, 60 membrane filters and 30 replicate tubes in the MTD tests, so experimental error is reduced materially.

These data indicate that in sampling a sewage contaminated river water the drop-plate yielded the highest coliform organism count. The MTD technique count was 1.24 times greater than that for the MF procedure.

The coliform counts that were approximately 25 percent lower on the MF than the MTD were of great interest. As previously stated about the same counts were obtained by the drop-plate technique on agar and the membrane filters. It could be that the filtration process was responsible for lowering the counts. Accordingly, a series of tests was run where the amount of water filtered was the only variable. In the first series, 0.2 ml of sewage-contaminated river water was planted by the drop-plate method on M Endo-MF (Difco) agar. Secondly, 0.2 ml of sample was filtered through a membrane filter (replicated 9 times) and the membrane placed on M Endo-MF (Difco) agar.

In a third series, 9 membrane filters were seeded with 0.2 ml followed by a 5 ml wash of sterile buffered dilution water. In a fourth series, 9 membranes were seeded with 0.2 ml followed by 100 ml of sterile buffered dilution water and in a fifth series the 0.2 ml was followed by 200 ml sterile buffered dilution water.

The counts for the various series of tests are reported in Table 2. The drop-plate counts gave a geometric mean of 27.1 colonies and the MF receiving only 0.2 ml yielded 22.4 showing that the filtering action on 0.2 ml did not produce a significant reduction in colony numbers. When 5 ml sterile buffered water followed the 0.2 ml inoculum, the geometric mean count was 20.2 and when the 0.2 ml inoculum was followed by 100 ml and 200 ml the mean counts were 13.2 and 12.8. The passing of volumes of 100 and 200 ml of water resulted in a lower coliform count, although the inoculum was constant. The values showed that counts with

Table 2

The Effect of Volume Filtered on the Number of Coliform Organisms Detected by the Membrane Filter Technique Using 0.2 ml of Sewage Contaminated River Water.

Trial	Coliforms per 0.2 ml of sample*				
	Drop Plate	Membrane Filter Technique			
	Amount of Sample + buffered dilution water				
	0.2	0.2	0.2 + 5	0.2 + 100	0.2 + 200
1	28	27	27	3	4
2	30	20	27	5	6
3	31	18	25	1	14
4	25	18	22	21	11
5	25	33	33	34	22
6	23	42	27	6	25
7	28	25	30	28	27
8	28	39	22	22	21
9	27	29	20	36	19
10		32	25	22	21
11		14	8	16	16
12		19	15	24	12
13		12	9	18	11
14		22	18	21	4
15		12	22	17	4
Geom. Mean	27.1	22.4	20.2	13.2	12.8
Percent reductions		17.4	25.5	51.3	52.8

*Medium used—M Endo MF (Difco).

the 100 and 200 ml filtration were significantly smaller than the control.

This experiment has been repeated a number of times and each time a marked reduction occurred when 100 ml and 200 ml of water were used.

These data demonstrate that large volumes of water passed through the filter over the coliform organisms trapped on the filter tended to reduce colony counts. This may be due to damage to some cells, thus stopping reproduction. In a later paper, data will be presented which will show this to be true.

When selective agents, such as bile salts, brilliant green, fuchsin, etc. are added to a medium to prevent the growth of gram positive bacteria, the amounts needed have a slight inhibitory action on the gram negative organisms as well. Many media such as brilliant green bile broth, oxbile broth, 0.1 percent phenol broth, fuchsin broth, and crystal violet broth were designed originally for the primary growth of coliforms from water. However, upon testing for this purpose, they were found inhibitory to some coliform organisms and were then used as confirmatory media, where organisms in their logarithmic growth phase could withstand the inhibitors. Only one of these media is recognized by *Standard Methods,* namely brilliant green bile broth and in this medium a large inoculum must be used to assure growth of the coliform organisms.

The viable coliform cells in water vary in their ability to reproduce depending upon the environment. Organisms in sewage reproduce readily because they are only shortly removed from their logarithmic growth phase. Coliform organisms in ground water acquifers and in rivers and lakes may be in the stationary phase of their growth cycle so considerable time may elapse after being placed in a nutrient medium before reproduction starts and if the medium is not fully adequate for growth, or inhibitory substances are present, reproduction may never occur.

An ideal medium would be one that makes possible the growth of viable coliform organisms present irrespective of their degree of viability. Such a medium would yield 100 percent of the viable coliform organisms present in swimming pools and finished waters where chlorine may have only injured the cells, in ground water acquifers where low temperatures may have reduced viability, and in sewage where organisms are only shortly removed from their growth phase. As far as the authors are concerned, no such medium exists. In comparisons of lauryl tryptose broth and lactose broth, McCrady[12] reported that lauryl tryptose broth was only slightly better than lactose broth in sewage contaminated waters, but in swimming pool waters 13 percent, in wells and springs, 17 percent, in sea water 25 percent, and in miscellaneous waters in the marginal classification 37 percent better in the detection of coliform organisms.

The senior author observed in a study of lauryl tryptose broth and lactose broth on finished water that coliform organisms were always detected first in the lauryl tryptose broth and sometimes only in lauryl tryptose broth. In water plant operation, lauryl tryptose broth would be the medium of choice for finished waters and waters in the various stages of treatment for this reason.

The medium used in the membrane filter technique contains inhibitory agents and filtering of large amounts of water appears to reduce the number of culturable coliform organisms. Because of this, samples of various types of water were tested. 25 replicate tubes in 3 dilutions for the MTD and 5 membrane filters were analyzed in appropriate amounts, depending upon the coliform density of the sample, to determine the constancy in

Table 3

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Sewage Contaminated Water from a River.

Sample No.	Coliform Indices		Ratio MF:MTD
	MF*	MTD**	
1	3,700	29,700	1:8
2	9,500	19,300	1:2.03
3	13,000	14,600	1:1.2
4	12,400	12,400	1:1
5	12,000	4,400	1:0.36
6	10,800	12,200	1:1.13
7	9,600	9,200	1:0.96
8	13,600	9,000	1:0.66
9	30,700	35,000	1:1.14
Geom. mean	11,300	15,100	1:1.3

*5 trials of each dilution—M Endo MF Medium (Difco).
**5 trials of 3 decimal dilutions of 5 tubes each—lauryl tryptose broth (Difco).

detecting culturable coliform organisms.

Table 3 presents test results of a sewage contaminated river on different days. With the exception of one sample the counts obtained by both methods are in fair agreement. These results would be anticipated as the coliform organisms encountered represent relatively fresh contamination of the river at the collection point.

Table 4 presents the results from 4 deep wells that were known to be contaminated. The ratios varied from 1 to 5.4 to 1 to 1.04 in favor of the MTD procedure. Well No. 3 was badly contaminated and the ratios for the two samples tested were 1 to 1.04 and 1 to 1.18. Also in Table 4 are presented data on three samples from a shallow well. The contamination was largely *Aerobacter aerogenes* and probably was caused by the use of priming water of questionable quality. The counts obtained by the MTD procedure were approximately double that for the MF technique. The contamination was high, but the organisms were likely in the stationary growth phase.

In Table 5 the data represent samples collected from rivers and lakes. The first river travels through sparsely settled areas and no municipal sewage enters above the point of sampling. The water is clear and no deposit occurred on the filters when 100 ml amounts of water were filtered. The ratios vary from 1 to 146 to 1 to 5.4. Although the coliform organisms were high in number, the MF failed to cultivate them. The second river carries no municipal sewage above the point of collection but travels through an agricultural area. The ratios here were 1 to 9.4 and 1 to 9.8. Again, although the coliform population was high the MF technique failed to detect them.

The first lake at the point of collection was heavily contaminated by bathers. The ratio was 1 to 7.4. This lake is biologically active so the MF technique may not have functioned because of other bacteria that were present. The second lake is biologically active with no sewage contamination. Ratios of 1 to 81.8 and 1 to 32 were obtained. Again the MF technique failed to detect culturable coliform organisms.

Great Lakes Water

Five raw water samples from five water purification plants obtaining water from the Great Lakes were selected for testing. These waters were selected because they are the nearest in coliform population to an acceptable potable water available and they represent the types of waters for which the MF technique is especially suitable. If the technique failed to detect culturable coliform organisms from these waters then obviously failure would be true for finished waters where the probability of finding coliform organisms is low.

In Table 6 are presented data for a city receiving lake water of relatively good quality. Eleven samples were collected at the plant on different days.

There is no need for a statistical analysis of the data, as the differences are markedly in favor of the MTD procedure. Remembering that the 95 percent confidence limits for 25 replicates would be approximately 45 percent for the lower limit to 65 percent for the upper limit (13), only one sample, No. 10, would be in agreement.

In Table 7 are presented data from a city water supply from the same lake, but showing considerably more contamination. Although the ratios are closer than in the water reported in Table 6, in only one instance is there agreement between the two methods.

In Table 8 data are presented for a city water supply from another

Table 4

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Water from Contaminated Wells.

Well No.	Coliform Indices MF*	MTD**	Ratio MF:MTD
		Deep Wells	
1	44	240	1:5.4
2	7	16	1:2.2
3(a)	101	106	1:1.04
(b)	844	996	1:1.18
4	108	193	1:1.78
		Shallow Well	
5(a)	2,350	4,900	1:2.08
5(b)	2,600	4,370	1:1.68
5(c)	2,060	6,160	1:2.99

*5 trials of each dilution—M Endo MF Medium (Difco).
**5 trials of 3 decimal dilution of 5 tubes each —lauryl tryptose broth (Difco).

Table 5

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Surface Waters.

Sample No.	Coliform Indices MF*	MTD**	Ratio MF:MTD
	River (relatively clean)		
1	12	1,760	1:146
2	16	489	1: 30.5
3	54	295	1: 5.4
	River (agricultural pollution)		
4	408	3,840	1: 9.4
5	638	6,250	1: 9.8
	Lake (contaminated)		
6	64	477	1: 7.4
	Lake (uncontaminated)		
7	22	1,800	1: 81.8
8	40	1,280	1: 32

*Trials of each dilution—M Endo MF Medium (Difco).
**Trials of 3 decimal dilutions of 5 tubes each—lauryl tryptose broth (Difco).

Table 6

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Lake Michigan Water from the Intake at Water Treatment Plant No. 1.

Sample No.	Coliform Indices MF*	MTD**	Ratio MF:MTD.
1	0.4	10.6	1:26.
2	0	0.4	—
3	2.2	26.8	1:12.
4	0.4	9.6	1:24
5	0.36	11.2	1:31
6	0	0	—
7	2	7	1: 3.5
8	26.	24.4	1: 0.93
9	0	46.5	—
10	1.2	4.16	1: 3.5
11	1.5	8.57	1: 5.7

*5 Trials of each dilution—M Endo MF Medium (Difco).
**5 Trials of 3 decimal dilutions of 5 tubes each —lauryl tryptose broth (Difco).

Table 7

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Lake Michigan Water from the Intake at Water Treatment Plant No. 2.

Sample No.	Coliform Indices MF*	MTD**	Ratio MF:MTD
1	5	30.4	1:6
2	2.2	17.4	1:7.9
3	9.	26.9	1:3
4	96	138	1:1.4
5	69	619	1:8.9

*5 Trials of 100 ml each—M Endo MF (Difco).
**5 Trials of a 3 decimal dilution of 5 tubes each—lauryl tryptose broth (Difco).

lake. The raw water from this plant generally shows greater coliform indices than those reported in Tables 6 and 7. Ratios can be reported on only three samples, 1 to 3.3, 1 to 18.7 and 1 to 16. In the other two samples, no coliform organisms were detected in 500 ml of sample by the MF technique, whereas the MPNs were 97.8 and 26.6. The MF technique failed to detect culturable coliform organisms. No agreement was obtained on any samples.

In Table 9 are presented data on another city water supply from the same lake as that reported in Table 8. This raw water gives variable numbers of coliform organisms due to sewage effluent in the area. Agreement occurred between two samples, one with high coliform and the other with low coliform populations. No culturable coliform organisms were detected in two samples using the MF technique.

Table 8

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Lake Huron Water from the Intake at Water Treatment Plant No. 3.

Sample No.	Coliform Indices MF*	MTD**	Ratio MF:MTD
1	0	97.8	—
2	0	26.6	—
3	70	234.	1: 3.3
4	8	130.	1:16
5	10	187.	1:18.7

*5 Trials of 100 ml each M Endo MF—(Difco).
**5 Trials of a 3 decimal dilution of 5 tubes each—lauryl tryptose broth (Difco).

In Table 10, data are presented from a water supply source that seldom shows coliform organisms by the MTD tests. Coliforms were detected in two samples by the MTD test whereas no culturable coliforms were obtained using 500 ml of water by the MF technique.

These data (Tables 3 to 10 inclusive) demonstrated that where coliforms of recent fecal origin were present, the MTD and MF tests gave comparable results although the MF counts are in the lower bracket of 95 percent confidence limits. When coliforms were apparently in their stationary phases, characteristic of marginal waters, the MF technique, as presently performed according to *Standard Methods for the Examination of Water and Waste-Water,* 11th Ed. failed to yield many of the culturable coliform organisms and yielded results not comparable to those obtained using lauryl tryptose broth in the MTD test.

Table 9

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Lake Huron Water from the Intake at Water Treatment Plant No. 4.

Sample No.	Coliform Indices MF*	MTD**	Ratio of MF:MTD
1	0	4.4	—
2	0	4.7	—
3	678***	764	1:1.1
4	2	16.5	1:8.2
5	5.2	6.7	1:1.3

*5 Trials of 100 ml each—M Endo MF (Difco).
**5 Trials of a 3 decimal dilution of 5 tubes each—lauryl tryptose broth (Difco).
***Appropriate dilutions used.

On the waters examined in this study, Standard Methods provided two standards, one more sensitive than the other.

If a standard of sanitary quality is to be maintained of not more than one coliform per 100 ml of water, then when alternate methods are offered, the results from these methods should be similar.

Other Reports

The results presented in this report are not different from those presented by others, if the data are treated the same as those in this report. Kabler[14] in 1954 reported on a survey made by a committee on the comparative results obtained by testing various waters with the MTD procedure using 5 replicates of each dilution and membrane filters. The results were reported on the basis of 95 percent confidence agreement or disagreement. Many samples wherein no coliforms were detected with either method were reported and included in the summation of the data. These samples, which yielded no information on the comparative value of the two methods constituted approximately 25 percent of the samples.* These samples are reported as in "negative agreement" and are included as showing that the two methods are in agreement. If these samples are excluded, instead of an agreement of 74 percent, the agreement becomes 60 percent. In a group of samples collected from waters in the potable category, 650 samples were reported. In this group there were 114 listed as ± agreement, 457 negative agreement and 79 in disagreement. By adding the ± and negative agreements together, 88 percent were in agreement. However, if the 457 negative agreements are discarded as showing nothing in regards to the merits of the two methods in detecting coliforms, the agreement is only 58 percent. The agreements of 60 percent for the first group and 58 percent for the second group show that the two methods are different in their sensitivity, and that the MF technique only detects part of the culturable coliform organisms present in the water. The author states "These results indicate that the two test procedures do not measure precisely the same group of organisms and that the sanitary significance of the differences in results of the procedures is yet to be determined."

Table 10

A Comparison of the Coliform Indices Obtained by the MTD and MF Methods Using Water Taken from a Ranney Collection System in Lake Michigan Water Treatment Plant No. 5.

Sample No.	Coliform Indices MF*	MTD**	Ratio of MF:MTD
1	0	0	—
2	0	0.8	—
3	0	0	—
4	0	0.4	—
5	0	0	—

*5 Trials of 100 ml each—M Endo MF (Difco).
**5 Trials of a 3 decimal dilution of 5 tubes each—lauryl tryptose broth (Difco).

Conner[15] in an examination of sea water presented three tables of data for three different sampling locations. The MTD values were calculated from a three tube replicate dilution procedure. The MF tests were made on EHC and BGF media; and the latter gave the highest coliform organism counts. An arithmetic average was taken of each set of data for both MTD and MF techniques.

*Facetiously, if one method used a medium containing a germicide, and no coliforms were present in the waters in the quantities tested, both tests would yield negative results. Certainly the two methods would not be in agreement in detecting coliform organisms. To make a comparison of two techniques, there must be something to compare.

The average MPN was adjusted for a positive bias of 43 percent and confidence limits for a 3 tube test were 0.21 to 3.95. An agreement of 89 percent was obtained.

These writers present the data from the three tables in graphic form (Graphs 1, 2 and 3) arranging the samples in descending order for the MPN values. The 95 percent confidence limits are indicated by shaded area. It will be observed that although nearly all the MF counts are within the 95 percent confidence limits of the MPN values, they are, without exception, in all three graphs on the borderline of the lower confidence limits indicating a lower population level. The ratios of the MF counts to the MPN value based on the geometric means are 1:1.3 for graph 1 and 1:2.6 for graphs 2 and 3

Presnell, Arcisz and Kelly[16] presented MF counts and MTD values on sea water from three stations. They report that the percentage agreement for the two methods was higher for waters of high coliform populations than for waters of low or moderate coliform populations. A comparison of the geometric means for each table showed a ratio for Station C (high coliform populations) for the MF to the MTD of 1:0.9, for Station A (low coliform populations) 1:1.6 and Station B moderate coliform populations 1:2. With the exception of Station C, the MF counts are close to the lower 95 percent confidence limits, indicating in general a lower count of culturable coliform cells.

Adams[17] in a comparative study of MF and MTD tests reported on 315 samples of prechlorinated Allegheny River Water. He reported 88.4 percent agreement by including 129 tests where both tests yielded negative results, giving no comparative data on the value of the tests in detecting culturable coliform organisms. If these are excluded, his percentage agreement drops to 56 which would indicate the results of the two tests were not the same. With raw waters having high coliform populations, the two methods gave approximately the same results, with ratios ranging from 1:1.02 to 1:0.884.

Summary

Data have been presented to show that the coliform indices of marginal and potable waters obtained by the MF technique are not comparable to those obtained by the MTD method. This creates a dual standard for potability if a coliform index of 1.0 is used.

Comparable results are obtained when organisms are in or near the logarithmic growth phase. However, more study is indicated to improve the media and techniques used with the membrane filter, to secure a more accurate enumeration of the culturable organisms present in relatively good waters, where the coliform organisms are generally in the stationary phase of growth.

References

1. Goetz, A and Tsunneishi, N. Application of Molecular Filter Membrane to the Bacteriological Analysis of Water. *Jour. AWWA*, **43**:943 (Dec. 1951).

2. *Standard Methods for the Examination of Water and Wastewater* 11th Ed. 1960. Am. Public Health Assoc., New York.

3. Mallmann, W. L. and Peabody, Frank R. A Surface plating technique for Enumerating coliforms in High Population Water and Sewage. (Submitted for publication).

4. Thomas, H. A., Woodward, R. L. and Kabler, P. W. Use of Molecular Filter Membranes for Water Potability Control. *Jour. AWWA*, **48**:139 (Nov. 1956).

5. McCarthy, J. A., Thomas, H. A. and Delaney, J. E. Evaluation of he Reliability of Coliform Density Tests. *Am. J. Pub. Health*, **48**:1628 (1958).

6. McCarthy, Anne Marie, Studies on the Membrane Filter Technique and its Application to the Detection of Coliform Organisms from Water. Thesis—Ph. D. Michigan State University 1956.

7. Hajna, A.A. and Damon, S. R. Coliform Detection in Water by a Single Step Technique using the Membrane Filter. *Pub. Health Rep.* **69**:58 (1954).

8. Fifield, C. W. and Schaufus, C. P. Improved Membrane Filter Medium for the Detection of Coliform Organisms. *Jour. AWWA*, **50**:193 (Feb. 1958).

9. McCarthy, J. A. and Delaney, J. E. Membrane Filter Media Studies. *Water and Sewage Works.* **105**:292 (July 1958).

10. Noble, R. E. and Reitman, Marvin, Influence of Basic Fuchsin and Sodium Sulfite on EHC Endo Membrane Filter Medium. *Jour. AWWA*, **51**:614 (May 1959).

11. Clark H. F., Geldreich, E. E., Jeter, H. L. and Kabler, P. W. The Membrane Filter in Sanitary Bacteriology. *Pub. Health Rep.*, **66**:951 (1951).

12. McGrady, M. H. A Practical Study of Lauryl Sulfate Tryptose Broth for Detection of the Presence of Coliform Organisms in Water. *Am. J. Pub. Health*, **33**:1199 (1943).

13. Halvorson, H. O. and Ziegler, N. R. Application of Statistics to Problems in Bacteriology. III A Consideration of the Accuracy of Dilution Data Obtained by Using Several Dilutions. *J. Bact.*, **26**:559, (1933).

14. Kabler, P. W. Water Examinations by Membrane Filter and MPN Procedure. *Am. J. Pub. Health* **44**:379 (1954).

15. Conner, R. M. Comparison of Fermentation Tube and Membrane Filter Technique for Estimating Coliform Densities in Sea Water. I Preliminary report. *Appl. Microbiol.*, **5**:141 (1957).

16. Presnell, M. W., Arcisz, W. and Kelly, C. B. Comparison of the MF and MPN Technique in Examining Sea Water. *Pub. Health Rep.*, **69**:300 (1954).

17. Adams, R. B. Comparison of Standard Dilution and Membrane Filter Methods *Jour. AWWA*, **49**:1452 (Nov. 1957).

Atlanta Report

The 88th annual report for the city of Atlant, Ga., reveals the success felt with the $10,000,000 Chattahoochee Water Treatment System during first year operations. The new system increased Atlanta's supply by 20,000,000 gal per day during 1960. And the plant saved citizens $7,000,000 over standard construction costs.

More than $1,500,000 were spent extending service to 15,000 new consumers. Cash water sales were $5,917,660.87, an increase of 3.4 per cent over 1959. Average daily pumpage was 73,742,000 gal. Rate of flow also increased, saving citizens over $300,000 during the year.

WPCF To Meet in Milwaukee In October

The 34th annual meeting of the Water Pollution Control Federation will be held in Milwaukee, Oct. 8-12. Highlighting 34 years of progressive water pollution abatement, the meeting will be opened Oct. 9 by Pres. Ray E. Lawrence.

The advanced copy of the program for the week has full information on the scheduled 15 technical sessions, which include over 50 top technical presentations. Highlights will be on industrial wastes, intercommunity sewerage systems, plant maintenance and an operator's forum.

Extensive manufacturers' exhibits will be presented in the large Milwaukee Auditorium, which has room for over 100 booths.

Hotel headquarters will be the Schroeder; alternates will be the Wisconsin, the Plankinton and the Milwaukee Inn.

For further information or a program, write the Federation office. For exhibit information write Mr. John G. Stewart, Water and Sewage Works Manufacturers Association,

Water Utility Distribution Loss

Part 3

EDITORS NOTE: This third installment of a series on water quantity accounting outlines the problem, discusses the utility system generally and the utility distribution system specifically. Predicated on complete metering and systematized accounting, the method is adaptable to machine accounting procedures. Staggering national distribution system loss, estimated at $50 million per year for operating costs alone, is well worth studying and correcting.

by DALE E. SMELSER
Knoxville, Tennessee

■ WITH THE plant meters accurately measuring the quantity of water flowing into the distribution system, and the unavoidable leakage estimated for a specific system, the next step is to examine all sources of loss that may be corrected.

The enormity of the waste problem, with its detrimental effect on the industry, would seem to merit an achievement criterion with which any utility could compare results obtained toward the prevention of loss. Admittedly, the many variable quantities that are included in the total will make such a procedure somewhat difficult. For this reason losses should be itemized for comparative purposes.

The city of Pasadena, California, has for many years determined the losses in the distribution system, and has maintained excellent records. The losses are detailed by showing the quantity and percentage of twenty items. In 1940 the total loss was 9.6 per cent of the production. This was reduced to 6.7 per cent in 1955. See table 4. The total loss is divided into:

1. Accountable water 78.99 per cent of the total loss.
2. Unaccountable water 21.01 per cent.

This record could well be used as a criterion.

Reservoirs and Elevated Tanks

A leak from a reservoir can go on for years unnoticed unless a special effort is made to do so. The positive way to determine loss from a reservoir is by shutting off the inlet and outlet, then measure the drop in water level, if any.

A hook gage is a good tool to measure the drop. It must be certain the valves are tightly closed. The dollar loss from leakage in a reservoir holding treated water will obviously be more than from one with untreated water where the cost is that of pumping only. The reservoir leakage at Pasadena amounted to 9.71 per cent of the total loss in 1940. For comparison purposes of this item it would be necessary to have the size of the reservoir and the type of construction, whether masonry, concrete, or steel.

Elevated Tanks

Overflows from elevated tanks are a potential source of loss which can be readily detected by inspection and the proper functioning of the altitude valve.

Main Breaks and Large Leaks

The water lost from a break in a main or an unusually large leak may be estimated reasonably well by considering the pressure and the duration of the flow. The quantity lost should be entered in the record. It would be difficult, if at all possible, to set up a standard for comparison on this item of loss by reason of the uncontrollable conditions that may sometimes cause breaks. As has been stated before, some controllable conditions may cause leaks, such as faulty construction. Each water system can well profit by giving attention to its construction practices, also the soil conditions, which can affect the future stability of a newly installed pipe line.

Hydrants

The periodic testing of fire hydrants is a normal procedure in the average water utility. The water used can be readily determined with a pitot tube, and in the absence of such a tube an approximation of quantity can be made by attaching a pressure gage to one nozzle, and measuring the exact diameter of the other through which it is to be flowed. Then with the minute hand on a watch secure the precise time duration of flow. Reference to a table will then give the quantity. For example, a nozzle of two and one-half inches in diameter will flow 920 gallons per minute at 30 psi with a coefficient of 90. The free flow from a hydrant in a business district may be objectionable, especially during the day, and to accomplish a test it will be necessary to attach a hose to the hydrant to carry the water to a sewer. Figure No. 6 shows curves procured by actual test as follows:

1. Discharge in gpm using 3 inch meter with 50

Table 4
Losses For Year Ended June 30, 1940
Pasadena, California[a]
(Production Minus Consumption)

Item No.	Item	Cubic Feet	Per Cent of Total Loss
1	Reservoir Leakage	6,422,960	9.71
2	Reservoir Evaporation	8,440	0.01
3	Reservoir Overflow	5,100	0.01
4	Reservoir Cleaning	2,842,000	4.29
5	Main Leaks	5,000,000	7.56
6	Chlorination, Flushing New Mains	27,000	0.04
7	Flushing Mains	22,465,600	33.95
8	Emptying Mains for Connections	158,000	0.24
9	Backfill use by PWD	718,600	1.09
10	Water Service Laterals	208,000	0.32
11	Meter Slip	11,000,000	16.62
12	Meter Testing and Cleaning	39,000	0.06
13	Fire Department Fire Fighting	58,000	0.09
14	Shop Uses (Washing Cars)	20,000	0.03
15	Fire Dept., Testing Hydrants	2,000,000	3.02
16	Miscellaneous Construction	20,000	0.03
17	Broken Fire Hydrants	16,000	0.02
18	Cooling Water at Pumping Plants	51,300	0.08
19	Sewer Flush Tank Use	650,000	0.98
20	PWD Landscaping Irrigation	556,200	0.84
	Total Accountable Water	52,266,200	78.99
	Total Unaccountable Water	13,905,100	21.01
	Different Between Products and Consumption (DL)	66,171,300[b]	100.00

[a]For Pasadena, California, population in 1940 was 81,864.
[b]9.6 per cent of production for 1940 which was reduced to 6.7 per cent in 1955.

Source: E. L. Smith, "Reducing the Spread Between Production and Consumption," *Water Works Engineering*, 109:454 (May, 1956).

feet of 2½ inch ID rubber lined fire hose.
2. Discharge using 50 feet of 2½ inch ID rubber lined fire hose.
3. Free discharge by table.
4. Meter Volumetric Accuracy Curve, three inch meter.

The water used for testing hydrants should be properly recorded and preserved for future reference.

Flushing Mains

Many, if not all, water systems will require some flushing of mains, the frequency of which will depend on the number of dead ends and the chemical content of the water. If a hydrant is suitably located it can be used for flushing, if not, a connection commonly referred to as a blow-off may be provided and used. The method for computing the water used is practically the same as described for testing hydrants. At Pasadena the water used for this purpose amounted to 33.95 per cent of the total loss in 1940. This item will, of course, vary from utility to utility and will be influenced by the construction of the system and the character of the water.

Distribution Operation Usage

A substantial quantity of water may be used during the installation, sterilization, and testing of new mains which should be measured as is done at Long Beach, California.

1. All water used for flushing mains, blow-offs—computed by the use of a pitot tube at the discharge of the flushing hose.
2. All water lost in draining and cleaning reservoirs—computed from information at hand.
3. All water used for settlement of trenches—measured by portable construction meters, which are tested frequently.
4. All water used in chlorinating mains—measured by rotameter on portable chlorination machine or by use of a pitot tube at the flushing discharge[10].

Lost Services

The lost or forgotten service is a source of water and revenue loss which justifies the attention of the utility. Where meters are provided many years after the service lines were installed, lost services are more likely to be found. A new service may be lost if there is not perfect co-ordination between the departments installing the service, the office and meter departments.

> "It may be necessary to make a house-to-house survey to determine which dwellings have water service and through what meter it comes. This is not quite as simple as it may seem, particularly in a system that has been so poorly handled that a program of this kind becomes necessary. It may be found that several houses are on one meter, that a meter is located on one street, and services a house on another street, that a meter has been installed and forgotten, or that lines run under one house to get to another. Absolute diligence and determination are very important. No house, dwelling, apartment, or building of any kind should escape this survey[11]."

Illegal Use of Water

The theft of water is not generally practiced, but it should be guarded against, because as will be described later there are isolated cases where the loss by theft was substantial. Water can be stolen by curious and devious ways, including direct connections to fire hydrants, by-passes around meters, connections to inactive service lines and the unauthorized use of private fire lines. Most utilities require the installation of detector type meters in all private fire protection service to discourage unauthorized use. It is good practice to seal all meter registers. Any account with an unusually low consumption, as compared to previous use, should be examined to determine the reason. An alert meter reader will do so as routine practice. The following are three instances of record where the theft of water amounted to a sizeable loss to the utility:

1. A swimming pool operator broke the lock on a meter by-pass valve, then opened the valve to allow the water to by-pass the meter after which he sawed off the valve stem.
2. One plant took two million gallons per day for apparently twenty-five years.[12]
3. At Gainesville, Georgia, a glaring instance of water theft was exposed, when an Ice Company executive was found guilty of stealing nearly three and one-half million gallons of water from the city. The Atlanta Journal, July 29, 1959, describes in detail this unusual case.

Free Service

Free water service is usually restricted to publicly owned buildings, parks, pools, and other municipal installations. Such service should be metered and the quantity limited to from two to three per cent of the system input. The water so used must be entered in the record of water accounting.

Unmetered Water Sales

Most water systems have some water sales that are not metered. If such sales are not properly handled by periodic inspection and adjustment a considerable loss may be experienced. At Knoxville for Jan., 1959, the unmetered sales totaled 5.344 mg which was 0.9 per cent of the input to the system. (See Table 5.)

Table 5
Unmetered Water Sales
Knoxville Utilities Board, January, 1959

Use	Million Gallons
Fire Department	1.920
Sewage Disposal System	0.162
Service Department, Street Cleaning	2.216
Sewer Repairs	0.685
Market House	0.350
Miscellaneous Sales	0.011
Total	5.344[a]

[a]Represents 0.9 per cent of system input.

The fire department determines the quantity used by the department, and is billed accordingly. The unmetered water sales should obviously be held to a minimum, and limited to from one to two per cent of the distribution system input.

Metered Uses by the Utility

All water used by the utility should be metered and accounted for in the record. This will include the use by offices, shops, garages, storage yards or any other facility that uses water.

Customer Meter Slippage

Meter slippage or under registration will too often account for the major portion of loss in a water system. This is an unfortunate situation since good business principles dictate the necessity for the largest obtainable revenue for the utility, while extending equitable treatment to all customers. It is well known to the industry that a sound meter program is a fundamental requisite for a water utility, yet this vital phase of the business is too often neglected.

Some State Public Utility Commissions have adopted regulations to cover the maintenance of meters. The Pennsylvania Public Service Commission requires that ⅝ incn meters be tested at 50,000 cubic feet or each ten years, whichever occurs first; ¾ inch at 100,000 cubic feet or eight years; 1 inch at 200,000 cubic feet or six years; and over 1 inch at least each four years.

Of twenty-eight departments reporting in a survey made by a committee of the Minnesota Section of the American Water Works Association fourteen made corrections, varying from two to five per cent for under-registration. The report stated that four per cent correction in general would be reasonable.[13]

Long Beach, California, sold 90.85 per cent of their water, and Mr. C. K. Wells reports that meters are assumed to register 96 per cent of water passing through them.

> "This conclusion is essentially verified by meter shop experience and records. Approximately four per cent of consumers' use which is not being registered on the meters represents approximately $85,000 in uncollected revenue for the year.[10]

In 1956, the Knoxville meter superintendent reported tests on 560 meters which were removed for the routine ten-year test. The results were averaged and reported as follows:

1 gpm Accuracy 88 per cent
¾ gpm Accuracy 78 per cent
½ gpm Accuracy 60 per cent
¼ gpm Accuracy 38 per cent
Very small rates 0 per cent

Meter Sizes and Consumption

The proper sizing of meters is essential for efficient registration. The probable customer demand will determine the size of meter, and in general it is better to choose an undersize rather than an oversize meter.

> "If the capacity factor (average delivery to rated delivery) is below 30 per cent the meter is considered too small. The meter is considered too large if the factor is over 150 per cent."[14]

After extensive testing and checking of service and repair records, a suggested annual delivery range was established by Mr. Charles Bachman[15] as shown in Table No. 6.

Table 6
Suggested Annual Delivery Range

Meter Size Inches	Mil. Gal. Min.	Mil. Gal. Max.	100's CF per Month Min.	100's CF per Month Max.
⅝	up to 0.25		-	28
¾	0.25	0.75	28	83
1	0.75	1.5	83	166
1½	1.5	3	166	332
2	3	6	322	665

[a]Charles Bachmann, "The Selection and Care of Water Meters," JAWWA,41:200 (February, 1949).

Meter Maintenance

A meter test and repair policy must be based upon the economics and existing conditions in a specific system, which obviously requires a study of the operating experience over a period of time.

Each meter (new or repaired) should be tested before it is placed in service, and the test results properly recorded and preserved. Three basic factors involved in testing water meters are:

1. The number of different rates of flow over the operating range of a meter required to determine overall meter efficiency.
2. Quantities of water necessary at the various test rates to provide reasonable determination of meter registration.
3. Accuracy limits which meters must meet at the

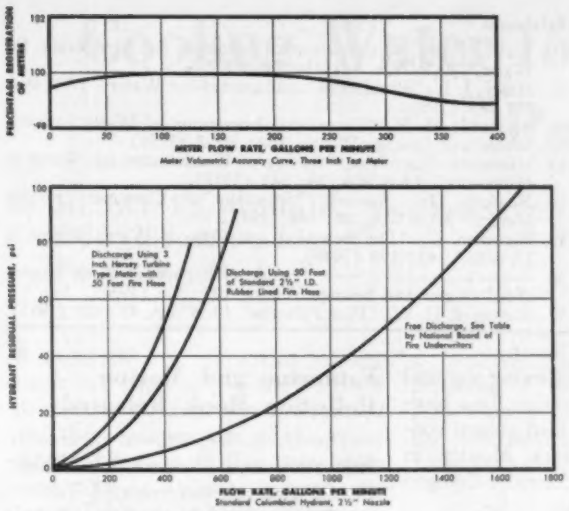

PERCENTAGE REGISTRATION OF METERS
METER FLOW RATE, GALLONS PER MINUTE
Meter Volumetric Accuracy Curve, Three Inch Test Meter
HYDRANT RESIDUAL PRESSURE, psi
Discharge Using 3 Inch Hersey Turbine Type Meter with 50 Feet Fire Hose
Discharge Using 50 Feet of Standard 2½" I.D. Rubber Lined Fire Hose
Free Discharge, See Table by National Board of Fire Underwriters
FLOW RATE, GALLONS PER MINUTE
Standard Columbian Hydrant, 2½" Nozzle

FIG. 6. HYDRANT FLOW TESTS

different rates to be acceptable for use.[16]

All meters removed from service for repairs should be tested (meter in test) prior to disassembly. The length of time the meter was in service, and the test results should be recorded. Curves may then be made plotting age against test rates, which will ultimately serve as a guide for meter removal. The weighted values in per cent of under-registration and probable loss of annual revenue per meter may then be plotted against meter age. The next step is to evaluate the average cost of repair with special attention to the applicable age group. Finally, from such information the average age for routines testing may be determined, also a curve may be made to show the cost of repairs plotted against meter age.

There is a great fund of literature on the subject of meters, relating the experience of utilities of various sizes. A complete treatise on meters has been compiled by the American Water Works Association, Meter Manual M 6.

Meter Accounting Periods

The problem of accounting periods which do not correspond in the accounting for water losses has been pointed out by Mr. Neimeyer[17] and others. This lead or lag due to different accounting periods for one month may be quite significant. This problem may be illustrated by explaining the method used at Knoxville, Tenn. The month of September, 1957, will be used. The distribution input meters are read daily, and totaled to obtain the quantity delivered to the system during the month. All meters on industrial accounts are read on the last day of the month. The domestic and commercial readings are handled as follows: Based on twenty to twenty-two working days per month, the meter reading routes are arranged to permit complete coverage of all meters each month. Each day, therefore, 1/20 of the meters are read and the account billed the subsequent day, on a continuous basis throughout the month. The Sept. 1st reading of customer meters will, of course, indicate the usage since the previous reading Aug. 1st, thus indicating the consumption during August. The Sept. 15th readings will be for water used since Aug. 15th, and the Sept. 30th readings will show the usage for the month of Sept. The readings for the entire month will average out over the entire system to be the water delivered through customer meters between Aug. 15th through Sept. 15th.

The following method for approximating corrections to account for meter reading period difference was made by the author. The total consumption from meter readings for the current month is added to the following month and the average for the two months is assumed to be the consumption for the current month.

For September, 1957, the computation is as follows:

Total domestic and commercial meter readings, September, 1957,	445 mil gal
Total domestic and commercial meter readings, October, 1957,	387 mil gal
Average for September and October	416 mil gal
Difference between the average and the September total	29 mil gal.

The difference of 29 mil gal for September amounted to almost seven per cent less water delivered to the consumers than the belated reports indicated. This will affect the unaccounted for water as follows:

Unaccounted for water as reported September, 1957,	3.5 percent
Unaccounted for water as corrected September, 1957,	8.2 percent.

Figure No. 7 shows graphically the effect of the difference between the accounting and corrected quantities each month for the two calendar years, 1957 and 1958. Referring to the upper graph the solid line (Ufw) shows the quantity as reported, the broken line (Ufwc) the quantity as corrected, and the horizontal line the average. The lower graph is intended to show the percentage of error in the accounting report as compared with the corrected report. That

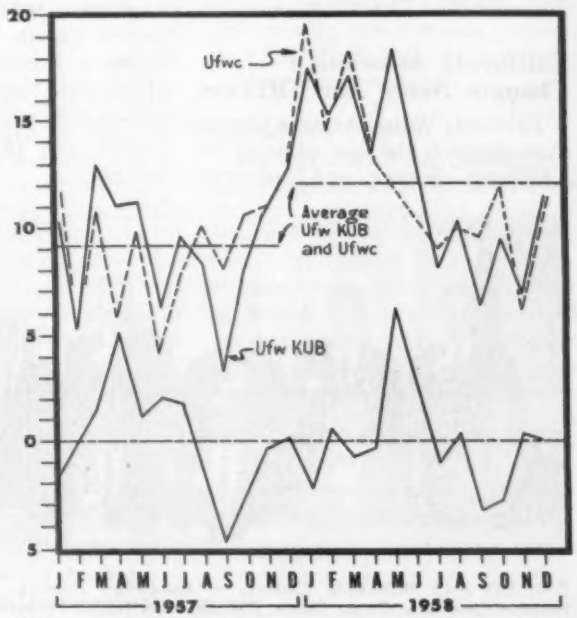


FIG. 7. EFFECT OF LAG in accounting period for domestic and commercial metering.

shown above the horizontal line indicates a larger quantity and loss than the corrected. That shown below the line indicates a lesser quantity and loss than the corrected. The symbols on the graph indicate the following:

Ufw—Unaccounted for water by accounting report.
Ufwc—Unaccounted for water by correction.
KUB—Knoxville Utilities Board.

In Part Four, the concluding portion of this series, a complete accounting system for water loss control, as designed by the author, will be presented.

References

10. Wells, C. K., "Long Beach Experience in Accounting for Water," JAWWA, **42**: 234. (1950).
11. Haley, J. L., "Problem of Unaccounted-for Water," JAWWA **51**: 389 (1959).
12. Beckwith, H. E., "Causes and Prevention of Water Losses," Water and Sewage Works, **102**: R222 (1955).
13. Minnesota Committee, "Survey of Unaccounted-for Water in Minnesota," JAWWA, **39**: 541 (1947).
14. Newkirk, Jr., Samuel, "Selection of Customer Service Meters," JAWWA, **39**: 198 (1947).
15. Bachman, C., "The Selection and Care of Water Meters.55 JAWWA, **41**: 199 (1949).
16. ———————, "Progress Report on Meter Standards," Water and Sewage Works, **103**: 335 (1956).
17. Niemeyer, H. W., "Pipe Failures," JAWWA, **47**: 459 (1955).

Water Resources Council Endorsed by Engineers

A proposal to establish a Water Resources Council, composed of four cabinet officers, has been endorsed by the National Society of Professional Engineers.

The proposal also asks for authorization for setting up of river basin water resources commissions nationwide and to provide for financing of state water resources planning.

The endorsement by the 56,000-member group was based on an official policy of the NSPE. The statement cites five problems which the legislation would help solve: The need for Federal coordination; The need for Federal, state and local coordination; The planning of uses of the river basin as a unit; The lack of agencies in many states; The need to relatively measure the projects with one another.

California Association Changes Name And Officers

California Water Pollution Control Association is the new name of the California Sewage and Industrial Waste Association following the lead of the National Federation. In a business meeting of the 33rd annual conference held in Santa Monica in April, the name was formally changed after a long discussion.

During the meeting, a host of new officers were elected: president, Elmer E. Ross, Oakland; 1st vice president, Paul V. Hennessy, Laguna Beach; 2nd vice president, Prof. Erman A. Pearson, U. C., Berkeley; and secretary-treasurer, Stephen H. Goodman, Campbell. Raymond Walsh, San Luis Obispo, is new director.

"Sanitation in the Sixties," the theme of the convention, was discussed by engineers and university personnel. More and better equipped engineers was the answer to the problem confronting future work.

The remainder of the conference dealt with situations in the field. Legislative policy was discussed by several experts in that area. Exchange of material between all levels of personnel was another subject of controversy. Synthetic detergents seemed also to bring considerable comment.

OFFICERS AND PROGRAM Chairmen of Association. Standing: Harvey Hunt, Berkeley; President Elmer Ross; Gerson Chanin, Oakland; Frank Peirson, Temple City; Gordon Magnuson, Whittier; P. H. McGauhey, Berkeley. Seated: Robert Bergman, Los Angeles; John Merrell, San Diego; Edward Sampson, Vallejo; Paul Hennessy, Laguna Beach; Ray Lawrence, pres WPCF; outgoing president Dennis O'Leary. (Photo from Western City Magazine).

Estuarine and Marine Pollution Book Released

The U. S. Department of Health, Education and Welfare, the Public Health Service, has released Technical Report W61-4 from the Robert A. Taft Sanitary Engineering Center entitled "Estuarine and Marine Pollution."

The booklet contains Selected Studies on biological, bacteriological, and physical aspects, with major emphasis on the United States literature. The booklet may be obtained from the Center in Cincinnati, Ohio.

UCLA Opens Hyperion Test Plant

A plan for reclaiming millions of gallons of waste water will be tested for two or three years by a UCLA engineer and the Los Angeles Board of Public Works.

The pilot plant, at the Playa del Rey Hyperion Treatment Plant, will be the test laboratory for a process to purify sewage water for filling artificial lakes and fire-fighting reservoirs.

The process, involving the use of algae ponds to lower the salt and bacteria contents of sewage water, was developed at the UCLA Department of Engineering by Prof. Albert F. Bush. His method adds a third purifying treatment to the two now used by the Hyperion plant.

By one inexpensive and simple treatment beyond the normal sedimentation and oxidation, Bush believes that most of the lost waste water, some 280 million gallons a day, could be saved.

Ultimately, some of the purified water will find its way back into the sinking underground water levels of Los Angeles, after additional natural cleansing steps.

Cooling Water for Air Conditioning
Part 2

by HENRY F. MUNROE, San. Engr.,
B-I-F Industries, Inc.
Providence, R. I.

■ METHODS FOR TREATING cooling water are patterned on the needs of the type of cooling system employed and the characteristics of the water supply being used. The two main catagories of cooling systems, the *Once Through* and the *Recirculating* systems have been explained in the previous discussion. The need and methods for treating the water used by each system will be discussed in the following pages.

Once Through Systems

In the once-through system, the use of large volumes of water somewhat limits the degree of treatment which can be economically applied. Treatment is usually confined to application of surface active agents, corrosion inhibitors, and slime and algae destroying compounds. One of the principal difficulties is the formation of calcium carbonate scale. This subject of calcium carbonate formation is discussed in detail under the section dealing with treatment of recirculating water.

The most common method of reducing scale formation in *once-through* systems is through the application of 1 to 5 mg/L of a glassy phosphate. There does not appear to be any appreciable advantage to increasing the dosage beyond 5 mg/L since large doses have led to deposits of phosphate scale. The addition of phosphate has another disadvantage in that it may encourage the growth of algae. However, combinations of phosphates, lignins, tanins and chromates may give particular benefits due to formation of colloidal complexes.

In some cases, sulfuric acid has been used for scale control serving to reduce the pH and alkalinity and to convert some calcium carbonate to the more soluble calcium sulfate. The use of sulfuric acid has, in many cases, very effectively reduced a positive Langelier Index and produced a more neutral (6.5 to 7.5) Ryzner Index. The nomogram for determining pH saturation by Langelier's formula is shown in Figure 4.

Effective corrosion controls can be obtained through the addition of alkaline compounds which increase the pH and Langelier Index, or through the application of corrosion inhibitors which form a protective coating on the metal. Lime, being relatively inexpensive, is used in some cases to increase the pH of the water.

One method of corrosion control is to add small doses of lime to bring the pH to 7 and then to sequester the calcium by the addition of 2 to 5 mg/L of glassy phosphate. Since large volumes of water must be treated, the unit cost can be kept very low using this method. While lime is used to decrease corrosion in once-through systems, it is not considered for use in recirculating systems because of the possibility of building up high calcium carbonate contents which might actually cause scale formation in heat exchangers. Soda ash and caustic could also be used in once-through systems except that high costs do not make such use economical.

The growth of organic slimes and algae not only interferes with flow rates but their presence materially affects heat-transfer rates. Although there are a number of algicides and chemicals which can be used to retard these growths or kill the organisms, many of them are toxic to humans and fish. Great care must be exercised in the selection, use and disposal of these materials.

The common algicides used in *once-through* systems are gaseous chlorine or calcium (or sodium) hypochlorite. Since many of these slime organisms can acclimate themselves to continued low doses, the accepted method is to shock treat the system. This requires the application of 10 to 25 mg/L of free chlorine for a period of 5 to 30 min, two to three times a day depending upon the severity of the growth and local conditions. Certain varieties of organisms can close their shells and avoid contact with the algicides during the shock treatment; therefore some knowledge of the actual character of the growth is necessary before applying treatment. In general, however, large doses of chlorine or the hypochlorites are common methods for killing slimes and marine growths in once-through systems.

Recirculating Systems

The treatment of recirculating cooling waters involves the same problems as encountered in the *once-through* systems but to a much higher degree since the water is continuously being re-used and the concentrating of solids is experienced. As in non-recovery systems, the formation of calcium carbonate scale

The demand for human comfort through air conditioning has, in many places, burdened water supply and waste treatment facilities.

This series of three articles is presented to give readers an appreciation of problems surrounding the use of cooling water in air conditioning. The subject is outlined for presentation as follows:

Part 1—Water for cooling.
Part 2—Water treatment requirements.
Part 3—Instrumentation and control of water quality.

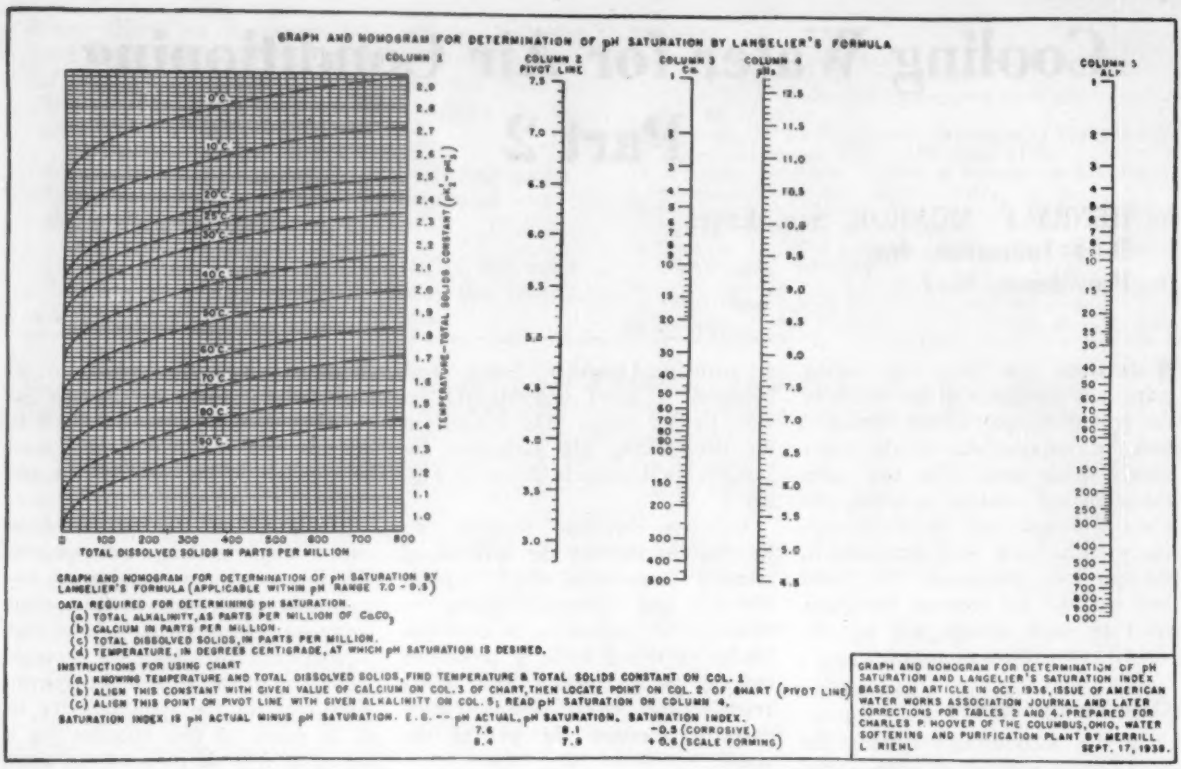

GRAPH AND NOMOGRAM FOR DETERMINATION OF pH SATURATION BY LANGELIER'S FORMULA
COLUMN 1
COLUMN 2 PIVOT LINE
COLUMN 3 Ca.
COLUMN 4 pHs
COLUMN 5 ALP
TEMPERATURE-TOTAL SOLIDS CONSTANT (pHs - pHa)
TOTAL DISSOLVED SOLIDS IN PARTS PER MILLION
GRAPH AND NOMOGRAM FOR DETERMINATION OF pH SATURATION BY LANGELIER'S FORMULA (APPLICABLE WITHIN pH RANGE 7.0 - 9.5)
DATA REQUIRED FOR DETERMINING pH SATURATION.
(a) TOTAL ALKALINITY, AS PARTS PER MILLION OF CaCO3
(b) CALCIUM IN PARTS PER MILLION.
(c) TOTAL DISSOLVED SOLIDS, IN PARTS PER MILLION.
(d) TEMPERATURE, IN DEGREES CENTIGRADE, AT WHICH pH SATURATION IS DESIRED.
INSTRUCTIONS FOR USING CHART
(a) KNOWING TEMPERATURE AND TOTAL DISSOLVED SOLIDS, FIND TEMPERATURE & TOTAL SOLIDS CONSTANT ON COL. 1
(b) ALIGN THIS CONSTANT WITH GIVEN VALUE OF CALCIUM ON COL. 3 OF CHART, THEN LOCATE POINT ON COL. 2 OF CHART (PIVOT LINE)
(c) ALIGN THIS POINT ON PIVOT LINE WITH GIVEN ALKALINITY ON COL. 5; READ pH SATURATION ON COLUMN 4.
SATURATION INDEX IS pH ACTUAL MINUS pH SATURATION. E.G. -- pH ACTUAL, pH SATURATION, SATURATION INDEX.
7.6 8.1 -0.5 (CORROSIVE)
8.4 7.8 +0.6 (SCALE FORMING)
GRAPH AND NOMOGRAM FOR DETERMINATION OF pH SATURATION AND LANGELIER'S SATURATION INDEX BASED ON ARTICLE IN OCT. 1936, ISSUE OF AMERICAN WATER WORKS ASSOCIATION JOURNAL AND LATER CORRECTIONS FOR TABLES 2 AND 4. PREPARED FOR CHARLES P. HOOVER OF THE COLUMBUS, OHIO, WATER SOFTENING AND PURIFICATION PLANT BY MERRILL L. RIEHL SEPT. 17, 1938.

FIG. 4. LANGELIER'S INDEX can be determined by graphical solution of Langelier's formula for pH saturation.

is a principal problem. The solubility of calcium carbonate is affected by a number of factors such as temperature, total solids content, alkalinity, and pH. All of these factors have been taken into consideration in the Langelier Index which is an equation for determining the equilibrium conditions for calcium carbonate solution. It is used to predict the tendency of a water to deposit or dissolve calcium carbonate scale and it is not intended to predict the magnitude of this deposition. Positive values of the Langelier Index (pHs) indicate a scale forming tendency; negative values indicate a tendency to dissolve previously formed deposits.

Since calcium carbonate is usually the major component of most scales, several attempts have been made to provide an index that would give an indication of the magnitude of scale formation. The most popular is the Ryzner Stability Index which is 2 times pH_s minus actual pH. When this index is below 6, corrosion decreases and scale formation increases. With values of 7 or higher, scale may not form and the tendency to corrode increases.

Scale prevention is much more critical than corrosion control. The use of the Langelier (pH_s-pH_{act}) Indices must be carefully practiced because of the concentrating process. In some cases where water supplies are limited and the supply has a high degree of hardness, it may be necessary to completely soften the water. The use of sulfuric acid to convert carbonates to sulfates is practiced to a much greater extent in *recirculating* systems than in *once-through* systems, not only because of the greater solubility of calcium sulfate, but also to reduce the alkalinity which attacks the lignin of the wood used in building cooling towers. The wooden construction of cooling towers is shown in Figure 5. Usually the pH is maintained between 7 and 7.5. If the sulphate content is originally very high, hydrochloric acid may be used for pH reduction.

FIG. 5. WOODEN CONSTRUCTION of cooling tower. Note butterfly valve and sampling tap on inlet line to tower.

The treatment for corrosion prevention usually involves the addition of an inhibitor such as chromates, phosphates or both in sufficient quantities to build up a protective coating on metal surfaces. Corrosion problems are more intensified in recirculating systems because of the re-use of water that is continuously re-saturated with CO_2, O_2 and other corrosive gases such as H_2S that may be picked up from the atmosphere. The interiors of evaporative condensers and cooling towers are shown in Figures 6 and 7, respectively.

The concentrating of dissolved solids is very troublesome in the

treatment of recirculating cooling waters and it is imperative that the allowable concentrations be determined periodically. The degree of concentration of total solids may be determined by comparing the chloride content of the recirculating water with the chloride content of the raw water. Although chlorides are usually determined because of the simple testing methods, sulfates or other compounds with high solubilities could be used as well. In general, the economic limit for solids buildup is two to three times the original raw water concentration. To maintain a lower concentration than this will require the disposal of a much larger volume of water (frequent blowdown). To allow higher concentrations of solids build-up may bring precipitation and scale formation. It should also be recognized that while solids concentrations may be theoretically increased and controlled from the standpoint of solubility, water remains an excellent washing media for air and collects gases and particles from it. In the recirculating process, large amounts of fly ash and other dust particles may be removed from the air. It may be necessary to increase the frequency of blowdown just to regulate the concentration of this foreign matter. If so, this higher blowdown rate automatically reduces chemical concentrations by becoming the limiting control.

The theory of corrosion inhibition by the formation of a tight protective coating evenly deposited throughout the piping system is the reason sparingly soluble metallic salts are used. Most of the anodic inhibitors such as chromates, polyphosphates, nitrates and hydroxides will inhibit corrosion if used in sufficient concentration. Sometimes, however, to maintain the required concentration of a single chemical is economically prohibited. In these cases, lower costs are possible by the synergistic action of two different anodic inhibitors such as the chromates and phosphates. Actually, there is a limit to the concentration of phosphate that can be used because of the low solubility of calcium phosphate. Recently, a glassy phosphate compound containing appreciable amounts of zinc was introduced, and although more expensive than the standard forms, it is claimed that lower concentrations will form a protective coating more rapidly.

Slime and algae growths in recirculating systems may: (1) interfere with the distribution of water throughout the tower, and reduce tower efficiency due to improper circulation, (2) release oxygen by photosynthesis, to aggravate the cor-

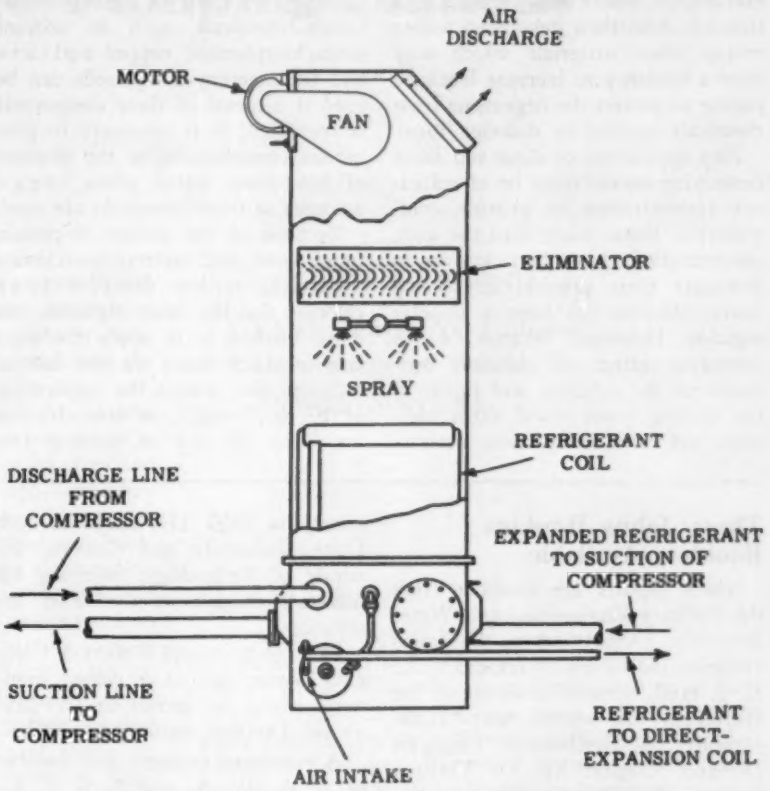
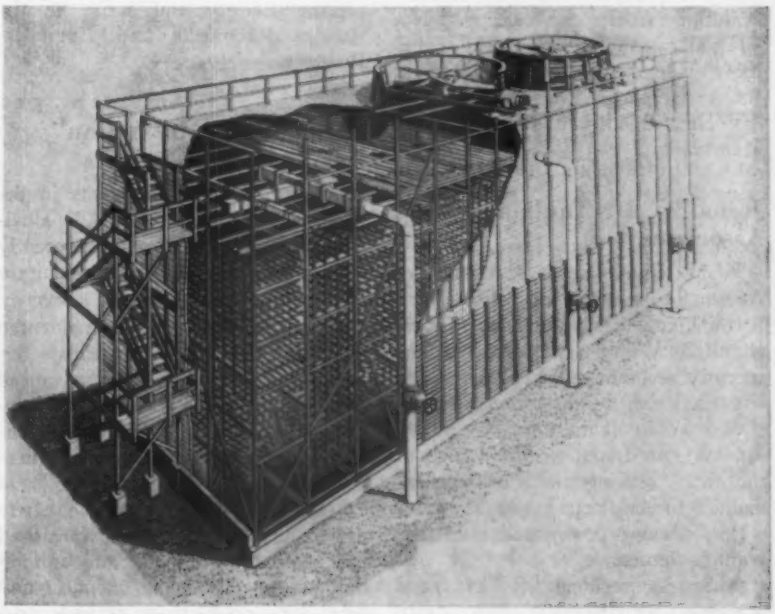


FIG. 6. INTERIOR of evaporative condenser with labeled components.



Courtesy of J. F. Prichard & Co.

FIG. 7. INTERIOR of cooling tower showing large surface area for water to pass over.

rosion problem, (3) prevent corrosion inhibitors from contacting the metal, and assist localized pitting. Slime growths are usually found in the dark, warm areas such as heat exchangers where they retard heat transfer. Also their gelatinous bodies entrap other materials which may have a tendency to increase localized pitting or protect the organisms from chemicals applied to dislodge them.

Any application of algae and slime destroying agents must be of sufficient concentration to provide complete kill. Doses lower than the toxic concentrations have been known to stimulate their growth. For many years, chlorine has been a popular algicide. However, because of the damaging affect of chlorine residuals on the cellulose and lignin of the cooling tower wood, other algicides are now being more actively considered. Some of them contain mercury and copper bases and many are toxic to fish life.

The Cooling Tower Institute does not recommend the use of oxidizing algicides for slime or algae control. Other chemicals such as sodium pentachlorphenate, copper sulfate and the mercury compounds can be used if disposal of these compounds is regulated. It is necessary to give careful consideration to the disposal of blowdown water when large amounts of these chemicals are used.

Because of the ability of certain fungi, yeast, and bacteria to acclimate themselves to low doses of free chlorine and the other algicides, the usual method is to apply the algicide in shock doses. In the case of chlorine, this means the application of 10 to 25 mg/L of free chlorine for 5 to 30 min at varying frequencies throughout the day. This application is usually governed by a program timer. Algicides other than chlorine are fed in a similar manner. This type of dosing is not only more effective, it is also more economical than continuous application of chemicals.

The treatment and effective control of cooling water is a major part of providing air conditioning. The quality of the cooling water must be maintained to prevent scale formation, corrosion and slime fouling of equipment. Constant supervision must be provided, especially with recirculation systems, in order to maintain this quality. Normally, such supervsion is more effectively provided by automated or instrumented systems.

Part III on instrumentation will be published in the next issue.

Three Johns Hopkins Booklets Available

Three reports are available from the Sanitary Engineering and Water Resources Department of the Johns Hopkins University. Authored by C. H. J. Hull, research associate at the University, the reports are: "Bibliography on Biochemical Oxygen Demand," Report No. V; "Oxygen Balance of an Estuary," Report No. IX; and "Public Water Policy on Low-Flow Augmentation for Stream-Pollution Abatement," Report No. VII, all extracted from The Low-Flow Augmentation Project at Johns Hopkins. For copies, write the Department at Baltimore 18, Maryland.

Joins W. D. Taulman & Associates

W. D. Taulman & Associates of Atlanta, Charlotte, Jacksonville and Birmingham, has announced that A. R. (Bill) White, Jr., of Atlanta, has recently become associated with their firm.

Mr. White is to join Mr. Wiley T. Baker in the Charlotte Office of the firm, serving the Carolinas as manufacturers' representative for water, sewage, power and industrial plant equipment.

A former resident of Texas and Virginia, Mr. White is returning to North Carolina where he received his Bachelor's Degree at Duke University in 1950. He taught at both Duke University and Georgia Institute of Technology, receiving his Master's Degree at the latter institution.

In 1954 he joined Robert & Company Associates as a design engineer, where he served in the Municipal Division until June, 1961.

A registered engineer and member of A. W. W. A. and A. S. C. E., Mr. White is a member of the Board of Directors of the Georgia Engineering Society and active in the Atlanta Architects and Engineers Institute.

"Engineering in Action" Details 1960 Progress

The story of developments in the Industries Divisions at Allis-Chalmers in 1960 is told in the recently released edition of "Engineering in Action."

Company activities are recounted in the graphically illustrated 36-page magazine, covering advanced work done on the fuel cell concept; progress made in procedures, facilities and equipment for power generation (including atomic power); and a recounting of some of the newly developed equipment A-C furnished for use in the metals and mining industry as well as in chemical and petroleum production, defense product needs, and general industrial applications.

What Price Water—Salt or Fresh?

Despite the current excitement about desalting the sea, the price of water delivered to the kitchen tap is still only a fraction of the cost of fresh water from the sea-water desalting plant.

On the basis of a valid cost comparison, even the cheapest desalted sea water is on the order of 20 times as expensive as fully treated fresh water.

Thus, according to the American Water Works Association, it will be some time before desalted sea water could be an economical alternative as the source of domestic water supply.

Actual desalting costs at the new Freeport, Tex., plant are reported as $1.00 per thousand gallons and up. There have been claims of lower costs for unproved techniques, but $1.00 is accepted as the present goal. This price does not include depreciation of equipment, delivery of the water or administrative expenses.

The average cost of a thousand gallons of fresh water, indicated by an AWWA survey of 497 utilities in the U. S., was 12.3 cents, including treatment, distribution, depreciation and administrative costs. The actual cost of treatment, including softening, is about five cents per thousand gallons. And this is the figure that is comparable with $1.00 cost of desalting.

Telemetering Sewage Pumping Stations

by GEORGE W. WELSH, Jr.
Chief, Bureau of Utilities
Department of Public Works
Towson, Maryland

■ In the interest of furthering economical operation and maintenance in our pumping and treatment program, a telemetering system is under way which, when installation is completed, will transmit an alarm signal from the stations to the maintenance yards.

The stations are now visited once daily by an operator and helper. There are currently seventy-seven units in operation including pumps, ejectors, water boosters and treatment plants. These units are divided into three operational areas, Eastern, Central and Western, requiring eight operators maintaining an average of nine units each. Operators are provided with an instruction sheet outlining daily duties in each station. After routine checking and chart changing, the remainder of the day is spent on special details such as wet well cleaning, pump repacking and other related work. Two specialized crews are assigned for repairs that operators are unable to make. An operating engineer is assigned to adjust and repair flow meters, miscellaneous trouble shooting, and major repairs. These specialized crews and the operating engineer cover stations in all areas.

We believe that when installation of the telemetering systems is completed, additional pumping stations can be satisfactorily maintained with present personnel. It is expected that some operators and helpers will be transferred to specialized crews. With continued growth of the system, this should result in overall savings in station operation and maintenance costs.

One Signal Telemetering

There are many elaborate and costly plans of telemetering systems to indicate equipment failure; however it is believed that the relatively simple design selected for this application will furnish adequate information. In the interest of economy, only one signal is transmitted from a station. The signal will indicate failure of the pump to operate, due to:

Power failure, high or low water, or clogged pump.
Excessive leakage or blown packing.
Failure of water seal system.
Flooding of pump room due to mechanical or piping failure.

Inasmuch as any one of these failures will require dispatching a man to the station, one signal should be sufficient. The signal is transmitted from the station to the area yard over a telephone company leased line. An instruction sheet is posted in the station setting forth the procedure to be followed in locating the trouble.

System Operation

If, for any reason, a pump fails to operate when required there is a time delay connected into the starter control circuit. The relay is interconnected to a limit switch mounted at the discharge check valve. When the pump fails to operate within the preset time, the limit switch remains open, the timer opens, and disconnects the circuit to the pump. Also, it simultaneously closes a relay connected to the telephone company leased line and transmits a signal to the yard.

In the event of high wet well level, a relay connected to a probe in the wet well closes, which in turn closes the relay connected to the telephone company lease line transmitting a signal to the yard.

An outside power failure automatically de-energizes the relay connected to the telephone company leased line, closing the circuit and transmitting a signal to the yard.

Any mechanical or piping failure which would cause flooding in the pump room, is sensed by a shielded probe wall-mounted approximately six inches above the floor. Liquid reaching this probe close a relay which, in turn, closes the relay connected to the telephone company leased line transmitting a signal to the yard.

Excessive leakage or blown packing is detected at the stuffing box reservoir. Here, a metal box holds an insulated electrode holder. When the liquid from the stuffing box reaches the level of the electrode holder, a relay is closed which in turn closes the telephone company lease line relay transmitting a signal to the yard.

In the event of failure in the water seal system, an electrically operated pressure switch connected in the timer circuit and placed in the water seal line would reopen and at the preset time, the timer opens, disconnects the circuit to the pumps and simultaneously closes the relay in the telephone company lease line and transmits a signal to the yard.

Report of London's First Effluent and Water Treatment Convention

by LEO WALTER
Technical Author
Painswick, Nr. Stroud
Glos., England

■ THIS EXHIBITION and convention, held during October 1960 for three days in London, was an unqualified success. The papers read at the convention were interesting and instructive, having been prepared by specialist engineers for engineers.

Although exhibition space and the number of exhibits were small, quality replaced quantity. On a total area of about 6,000 square feet, the exhibits included: instruments, valves, pumps, filtration plant, models of effluent and neutralizing plants, corrosion resistant materials, specialist engineers for engineers.

Abstracts from Convention Papers

In the following, abstracts are given from some of the papers. Complete papers of all presented are obtainable.

The Biological Treatment of Industrial Wastes By J. W. Abson, M. Sc. Tech., Ph. D., and K. H. Todhunter, M. Sc. Tech., A.M.I. Chem. E.

Aerobic biological decomposition provides one of the most efficient means of reducing the organic content of dilute liquid wastes. Two methods of treatment are in use today, the activated sludge system and the percolating filter. These processes differ insofar as plant and operation are concerned on the same biochemical principles.

Each process affords a means of bringing the bacteria into intimate contact with the waste and an adequate supply of dissolved oxygen. The efficiency of the process depends on how closely conditions in the plant resemble the optimal requirements of the bacteria.

The paper briefly outlined the structure and mode of reproduction of bacterial cells and the means of identifying and classifying bacteria. Factors influencing growth; e.g., availability of food, temperature, pH, osmotic pressure, toxic metallic ions and oxygen were discussed. The nature and mechanism of the agents responsible for the chemical activities of micro-organisms; i.e., enzymes, were explained. Effects of concentration, temperature, pH and protein precipitants were also mentioned.

The general oxidation of carbon containing substances found in industrial wastes is too wide a subject to deal with in detail but, in order to illustrate biological decomposition, examples have been limited to the breakdown of phenols, carbohydrates and proteins.

As stated above, the percolating filter and the activated sludge tank are the main types of plant in use. Both processes were described, together with reasons for selecting the one best suited to a particular waste. Types of waste amenable to biological treatment were listed.

Water Softening for Industrial and Public Supply Purposes By W. M. T. Boby.

This paper dealt with types of softening commonly applied in public and industrial wastes supply undertakings. The lime soda process was described in some detail, along with its advantages and disadvantages. Some elementary chemistry of water treatment was explained both regarding the lime process and ion exchange.

The ion exchange process in two forms was discussed. One form is base exchange for the ordinary softening of water to reduce or eliminate hardness regardless of whether it is bicarbonate hardness or hardness due to salts formed by mineral acid radicals. The other ion exchange system discussed was dealkalization by means of a weakly acidic resin which can be used to reduce or eliminate only the bicarbonate hardness. A comparison was drawn between this process and the lime process which produce approximately equivalent water qualities.

Industrial water softening was discussed and was sub-divided into two broad categories, boiler feed water and process water. The paper deliberately omitted discussing demineralization of boiler feed so to avoid overlapping with another paper given at this Convention. Instead, it gave in some detail the methods of water softening open to users of low and medium pressure boilers. Again, internal treatment was not discussed in any detail because it was discussed in another paper. The treatment of water for boilers operating up to 700 psi was brought out and, in the upper range, the question of silica reduction by hot lime treatment was covered.

Softening of waters for industrial purposes was dealt with rather briefly, and a few instances were given of industries in which soft water is normally found to be beneficial, although no attempt was made to give an exhaustive list or to detail the various types of treatment used.

Automatic pH and Redox Control in Cyanide and Chromate Effluent Treatment. By B. Mattock, B. Sc., Ph. D., A.R.I.C. and R. W. Uncles.

Automatic pH control in effluent treatment has been widely applied in recent years, and experience now indicates the most satisfactory way to proceed in particular cases. The major features were briefly discussed as a preliminary to an analysis of the redox techniques used in the control of cyanide and chromate treatments, where pH plays an important part.

Cyanide and dichromate wastes are most satisfactorily treated by chemical oxidation and reduction respectively, and efficient control

of these processes is important to meet legal and economic requirements. Instrumental monitoring with redox electrodes and control equipment has been pursued in England during the past eighteen months, and the experience gained, coupled with information gained from laboratory studies, now provides data on optimum control criteria and techniques.

Redox electrodes provide an indication of the ratio of oxidized to reduced species, and thus may be expected to follow cyanide oxidation by the chlorination in oxidizing cyanide to cyanogen chloride; the second stage, hydrolysis of cyanogen chloride, is the rate-determining one, and is accelerated by a high pH. The reaction time is catalytically reduced by the presence of an excess of chlorine. An examination of three redox electrodes, platinum, gold and silver, shows the first two do not respond fully instantaneously to redox changes. Although silver is faster, it gives inadequate signal discrimination above 10 ppm excess available chlorine.

Dichromate reduction with sulfur dioxide is dependent on the solution pH, occurring satisfactorily only at a pH of less than 3. An examination of the reaction characteristics, made with redox electrodes showed that reduction and response are favorable at a pH of 2.5 or less. Control procedures for the reduction are outlined.

It is important to emphasize that all redox systems must be examined individually for electrode behavior in order that the most satisfactory control settings can be selected. Although an indication can be obtained by laboratory titration of synthetic solutions, a further examination of effluent samples is highly desirable.

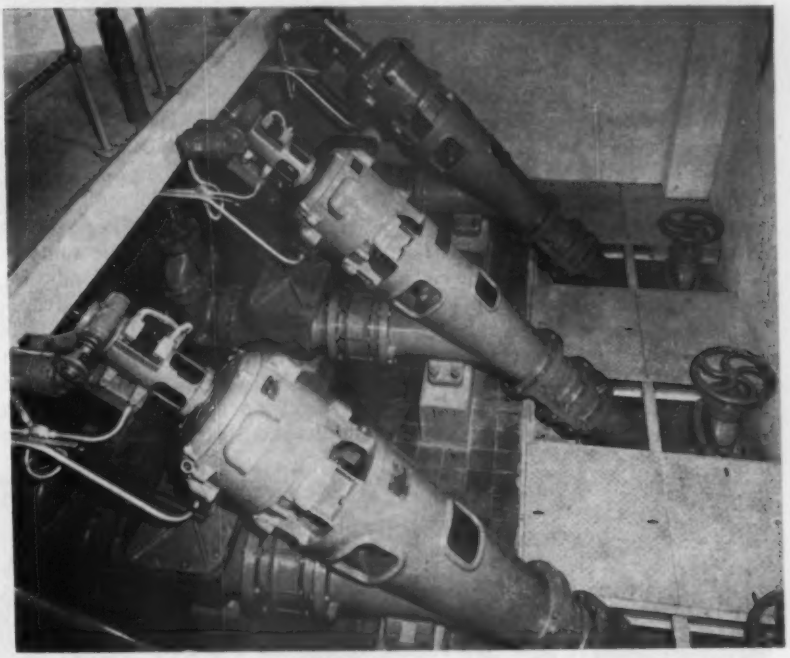
Problems of Design in Effluent Treatment Plants By J. W. Oakley, A.M.I. Mech. E.

A brief outline was given of the aims and more general methods of treatment of rinse waters and strong process wastes emanating from pickling of metals and from electroplating industries.

For the former, treatment is that of neutralizing free acids, precipitation of resulting solids and metallic hydroxides and sedimentation to limit the carry-over of the latter to sewers and waterways.

In the case of metal finishing and electroplating wastes, the added complications of toxic cyanides and chromates were referred to and reference was made to the problem of sludge disposal and the high cost involved in the transport of same, particularly where dewatering prior to disposal is not undertaken.

Examples of pickling wastes were quoted to show how plant design can be affected by the anticipated sludge volumes which will be formed and by the relative amounts and concentrations of free acid and metallic salts in the continuous rinse waters and the intermittent strong waste discharges. It was also shown that the choice of a neutralizing agent, such as soda ash to reduce sludge formation, may result in the further difficulty of high sulfate concentrations which would endanger sewer concrete. One example referred to the regeneration of strong sulfuric acid pickle wastes by cooling the hot liquid and precipitating the iron as copperas. Examples of discharges from electroplating wastes with cyanide, chromates and with these toxic contaminants wastes were quoted as general together. The design of the treatment plant is dependent on the limits imposed by the authorities governing effluent disposal with regard to concentrations of toxic constituents and suspended solids.



VICKERS-ARMSTRONG pumps installed at Spondon Sewage Disposal Works near Derby. Each unit handles 3,700 gallons per minute at a total head of 15½ feet. The Spondon Plant uses nine such pumps in its operations.

Factors affecting the determination of sizes of treatment tanks were discussed and reference was made to types of mixing gear employed in treatment tanks, to dry and liquid chemical feeders and pH control of the neutralizing process.

The types of settling tanks in general use were described; i.e., rectangular, vertical and radial flow types with the means employed to discharge sludge accumulations, and reference was made to overflow rates as the basis of settling tank design.

The Application of Polarography to the Analysis of Sewage and Industrial Water. By J. S. Hetman, F.R.I.C.

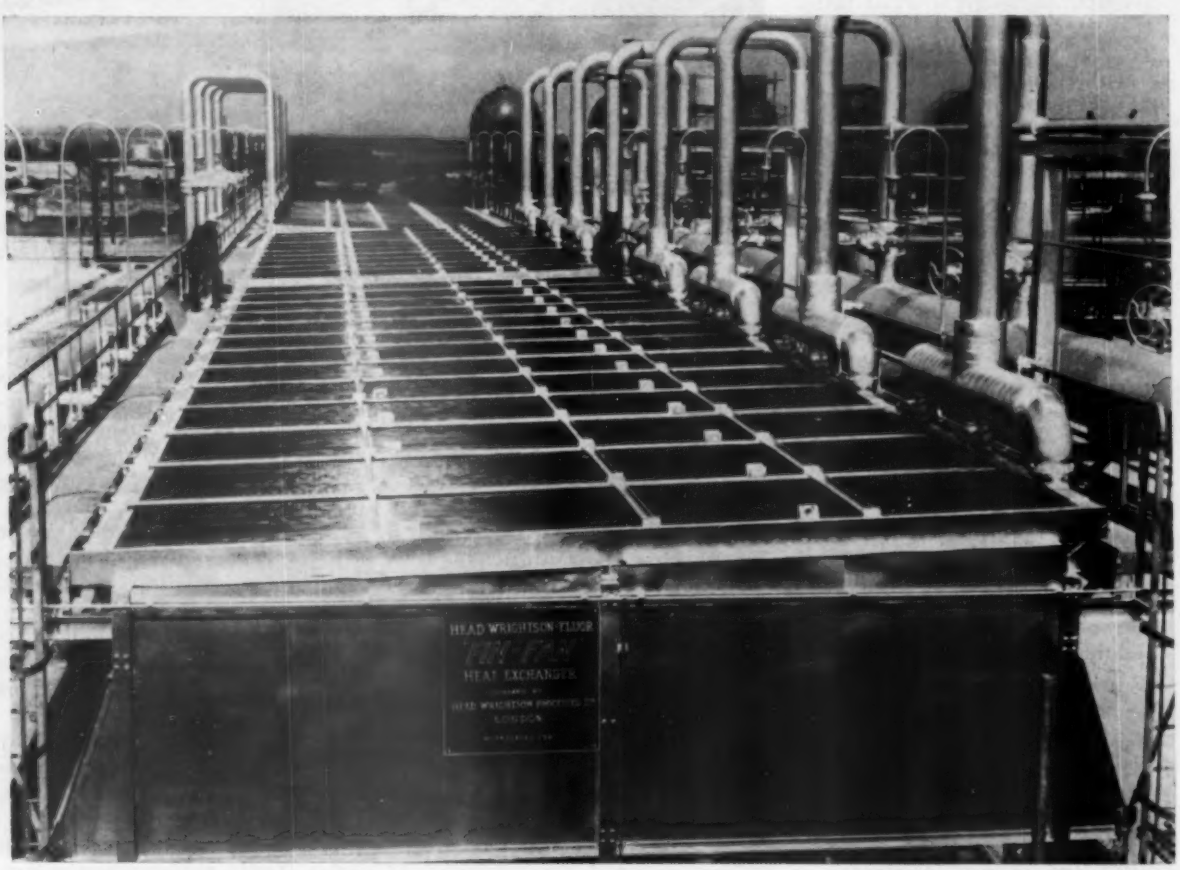
Chemical analysis is essential in water supply investigation and in finished water quality control. The frequency of general systematic chemical examination is governed

by local circumstances. Frequent chemical analyses are required for sewage and industrial water treatment and consequently for pollution control.

Industrial waters and sewage may contain various metallic ions in micro and macro quantities in various proportions. Up to 12 or 15 metallic ions could be present, and rapid accurate estimation of all of them is essential. Existing methods of analysis were described in British Standard 2690:1956. Methods of Testing Water Used in Industry International Standards for Drinking Water (World Health Organization 1958), and Standard Methods for the Examination of Water, Sewage and Industrial Wastes, 10th edition (American Public Health Association 1955). In general, the methods applied are classical, volumetric or gravimetric and colorimetric with absorbptiometric finishes for trace elements. Considering the determination of trace metals, particularly the determination of Cu, Pb, TI, Cd, In and Zn, working with modern and advanced photoelectric methods, chemical separation for every element is essential, applying various procedures such as precipitation, solvent extraction, ion exchange isolation and distillation. A considerable time is required with the result that high cost for each determination is inevitable and also a loss of some elements due to coprecipitation, adsorption on the filter paper, etc.

Few papers have been published on the application of polarography to water analysis, although polarographical methods have been shown to be of great value in the analysis of plant materials and foods for traces of metals. The main advantage of polarographical methods is the speed of determination achieved by the elimination of chemical separation, permitting the simultaneous determination of 2 or 3 elements, within the limits required for micro analysis. If several elements are present, conventional polarographical methods also require chemical separation, thus slowing the speed of analysis. This is possibly the explanation for the limited application of polarography to water analysis.

The work described the application of a linear sweep polarograph to this branch of analytical chemistry. A number of methods has been investigated for the simultaneous determination of various ions contaminating the waters. In a majority of cases, no chemical pretreatment is necessary to separate the elements, only acidification, adjustment of pH or dilution is required prior to polarographical analysis. In a water sample, acidified with HCl, Bi, Cu, Pb, Ti, In, Cd, and Zn; the water or water sample concentrations could be determined simultaneously in concentrations down to 0.1 ppm in



Courtesy Head Wrightson & Co. Ltd., London.

'FIN-FAN', the largest air cooled heat exchanger installation in Britain. Designed and manufactured by Head Wrightson Processes Ltd. for the Fawley Refinery, the heat exchanger is able to cool steam and hydrocarbon vapor with a heat load of 173 x 10° BTU's per hour at a dry bulb temp. of 90°F.

10-15 mins. Cu Pb, Fe and As can be determined simultaneously in an alkali medium (KOH, sucrose). Methods were also described for the determinations of V, Cr, Ni, Co, Na + K, Ca, Mg, Sn, sulfides, sulfites, sulfates and cyanides.

Disposal of Radioactive Effluent —an Increasing Problem. By P.A.L. Northcott, B. Sc. Ph. D., A.R.C.S., D.I.C., M.I. Nuc. E.

The increase in the use of radioactive materials for industrial and other purposes has led to an awareness of the problems associated with the disposal of radioactive wastes arising from such use. It was shown that the problem is one of control and suitable precautions can be taken to dispose of radioactive effluents with safety.

The methods of treatment and disposal which have been adopted in England by the U.K.A.E.A. and others were briefly reviewed and the legal position with regard to discharges of radioactive effluent prior to the Radioactive Substances Act 1960 were considered.

The Radioactive Substances Act has been introduced to control the use of radioactive materials from disposal of radioactive wastes. The Act was reviewed, and its possible effects on industrial users and local authorities were indicated.

Emphasis was laid on the absence of significant hazards arising from the disposal of radioactive wastes, provided suitable precautions are taken.

Application of Chlorine and Sulphur Dioxide in the Treatment of Trade Wastes. By J. F. Malpas, C. Sc., A.R.I.C., and P.E. Cockill. A.M.I. Mech. E.

Chlorine is a far more important chemical in trade waste treatment than sulfur dioxide, and calls for a brief discussion of its basic reactions in water treatment.

Both chlorine and sulphur dioxide have an important application in the treatment of metal finishing waste waters. Chlorine is used in the alkaline chlorination process for the destruction of cyanides, and sulfur dioxide for the reduction of hexavalent chromium wastes. The theoretical considerations of both these treatment processes were described.

Courtesy Vickers-Armstrong (Engrs.) Ltd., London.

VARIABLE PITCH pumps of 15,300 gallons per minute at a total head of 22 feet in operation at West Kent Main Sewage Board at Dartford, near London.

There were a number of important factors connected with the destruction of cyanides.

A high pH value is necessary to bring about the rapid hydrolysis of cyanogen chloride. The effect of chlorine on the complex cyanide ions of the various metals commonly found in plating wastes was also discussed. The reduction of chromates with sulfur dioxide is also dependent on the pH value, the reaction being more rapid at low pH values. After reduction it is necessary to neutralize the trivalent chromium and precipitate out the chromic hydroxide formed.

Practical considerations involved in designing a suitable treatment plant for metal finishing wastes were given in some detail. Special reference was made to the technique of applying the chemicals to give the most satisfactory and efficient treatment. Treatment schemes involving "batch" and "flow-through" methods were described.

Apart from the destruction of cyanides, chlorine has a great many other uses in trade waste treatment, but it is not always easy to assess the value of chlorination in any particular case. Chlorine has been used successfully in the bleaching of highly colored paper mill effluents, and its application in the treatment of phenolic and sulfide wastes has been widely investigated. An important use of chlorine is in the continuous preparation of chlorinated copperas and chlorine activated silica. Chlorinated copperas is a cheap, useful coagulant and activated silica a valuable coagulant aid. Both were widely used in conventional water supply practice as well as in the treatment of trade wastes.

Recommended reading in September-October issue of INDUSTRIAL WATER & WASTES:

Industrial Odors. Part 2—General Methods of Treatment
Fresh Water Monitoring Problems
Water Supply and Waste Disposal at a Food Processing Plant
Disposal of Tailings from a Mining Operation
Closed Cycle Coal Washing
Recent Developments in Handling Radioactive Wastes

Partially Oriented on . . .

Advance Friends and Be Recognized ..... Or!

■ JUST BECAUSE I haven't had the chance to write any letters recently, *The Economist* has jumped to the conclusion that "all the important recent advances in civil engineering have originated in some country other than Britain." *The Economist's* economists should have telephoned me first before issuing a statement like that.

For instance a remarkable and entirely revolutionary advance in civil engineering technology has taken place right here in this very office during the past few weeks, but, up to now, I haven't had the time to tell people about it. Mind you, a year ago I wouldn't have believed that the thing was possible at all, and six months later My Friend the Contractor was still saying it was impossible (for the money, at any rate). But here we are now with nothing to worry about (except money). What we have done, and the thing that is really of amazing significance, is that we have proved—as near as makes no odds—that construction drawings sent out by stool-bound engineers can sometimes be followed in the field. Of course one couldn't guarantee it every time; but even to know that it is possible once is a revolution in engineering thought. If the designer were to come on site now and look at this Thing we have built, he would not find it recognizably different from what he had intended, he would know that at least we had made an effort and got the spirit of his intentions written into the job. I know we shifted the Thing a bit to the left, and went a bit extra downstream, and didn't bother about using the rockfill, and changed the clayfill to concrete, and made the slopes a bit flatter, and had to use a thousand or so extra tons of steel in the tunnel, and found it easier to divert the roads the other way round—but, by and large, the designer wanted a dam hereabouts, and that is what we have given him. It only goes to show how good engineers are getting to be nowadays and that theory is well on the way to lining up with practice; and if that isn't an advance then I can't understand English.

Of course you don't make advances of this kind by conscientiously setting yourself out to try and do the impossible. You just take a look at the drawings of the structure you are supposed to build and, from then on, you have too many worries on your hands to think about advancing; all you have to do is to try and stop going backwards. There isn't any need to write up research theses on "recent advances made in civil engineering"—you are usually much too busy anyway writing the weekly reports explaining why the advancement isn't as advanced as the programme expected.

But even without the writing of theses, there are plenty of facts to be had which require no special "working up" into a theory. Thus, if this week's troubles are the same as last week's which were the same as the week before, and the week before that, and so on—then it doesn't need a thesis to be written before one reaches an Advanced Opinion or Conclusion.

It follows that, if I had anything to say about the disbursement of the £¼ million which is now to be spent on civil engineering research, then for every pound spent on testing concrete I would spend two pounds on testing the heads of the engineers doing the testing. Continuing this theme (since I am not involved and can therefore speak quite freely, query, I hope) I would also spend another two pounds per head testing the nervous system of contract lawyers in order to find out what frightens them into making written contracts more and more complicated and more and more useless as the years go past. Twenty years ago if you wanted a new pump in your waterworks you telephoned your friends who sold pumps and invited them round for coffee and asked them what they had for sale. In due course you got a nice new pump, all chromiumed-up with a "waterworks finish" and it ran for years and years and years and is still running today and everybody is perfectly happy about the deal from start to finish. But try buying a pump today—dear, oh dear, the fuss! Sheets and sheets of paper fly about, and the lawyers pile in Additional Clauses and Amendments to Clauses until everybody loses their grip on what was intended and it takes a five hour session of "both sides" with their solicitors in attendance, to find out if the valve indicator plates were to be chromiumed or brassed within or without The Contract. Someone ought to research us back to where we once were in this matter.

Then, of course, there is the research required on purely engineering matters—so multitudinous that I need hardly list them here, for are they not written week after week in my weekly reports from site? Yes they are. Leaving that subject for the moment (till next week maybe), perhaps I could mention some of my own personal researches, for which I think I might be entitled to a grant of 5 shillings towards a new typewriter ribbon. I have been busy compiling a new dictionary of civil engineering terms and think we may all find it useful. The new dictionary gives the actual meaning of certain words frequently found on the lips of engineers, as distinct from the normal meaning of the meaning. Thus the word *obviously,* almost certainly means—"without taking into account my blind spots." *Only a fiver* means—"eventually £50 or could be £500." *I will* means—"subject to the notorious weakness of my memory." *The legal aspect is . . .* means—

CONTINUED ON PAGE 128A

KEEP 'EM ROLLING

by C. G. Cunningham

■ ABOUT A YEAR ago this column used a feature about in-your-shop lube oil testing to determine your oil change period. The column brought so many responses for additional details, that we'd like to present another type of field check on oil.

This one is called the Simplex oil testing kit, and is produced by Lengor Inc. of Annapolis, Maryland.

As you may remember, there are two ways you can decide when to change oil. One is by a scientific test, the other is by guess and fish hook. Most of us use the scientific basis, however a complete laboratory analysis is not always needed. When this situation arises, the simplified semi-scientific type of field check often is the ideal method for oil testing.

The Simplex oil testing kit is of this type. It is contained in a small kit for field use and is relatively inexpensive when compared with laboratory testing.

The kit makes three tests: Abrasive solids, for acidity and for viscosity. The hand pump is used to draw a sample of oil from the crankcase. One drop is put on a piece of blotter-like paper. The oil ring that forms is compared against a series of sample stains on a chart and matched with the closest sample. If the sample is a uniform shade of gray, the oil is still useable. But if the stain is dark in the center, the dispersants in the oil have been depleted, and impurities are settling out. Both oil and filter need a change.

For acidity oil is placed in a reaction vial and mixed with an equal amount of reagent. If acid is present the oil changes color. A color chart shows how much acid is present.

Viscosity testing is handled in the two drip bowls seen at the right in the picture. A standard viscosity oil with average dillution is in one jar. Sample oil goes in the other. Then both cups are filled and timed as they drain through a standard sized hole. The drain rate is inversely proportional to the viscosity. Dilution exceeding minimum level of acceptance is easily checked.

Checks can be established on a mileage or a time basis to determine exactly when each of your water or sewer trucks have used their oil to the point where it should be changed.

Occasional laboratory analyses should still be made to double-check the findings.

Installing brake blocks on any type of a truck is one of the most important repair jobs you can do.

Brake block installation will determine to a large degree how well your brakes work. Follow these suggestions:

- Use steel bolts or rivets on metallic linings or blocks, and use brass bolts or rivets on organic material. Always use new lock washers.
- Use a torque wrench when installing sintered metal blocks and apply no more than 20-25 pounds torque. Use 10-15 pounds of torque on organic blocks. Use cast steel shoes or high tensile bands with sintered metals to avoid bolt hole elongation and breakup of sintered metal parts.
- Exercise care when riveting sintered metal materials to avoid chipping off small particles or cracking the part. Use roll set to insure air tight fit between lining and shoe or band.
- Do not use shim material with sintered metal.
- Do not combine sintered metal and organic friction parts on the same brake assembly or the same axle.
- Hone drums which are to be used with sintered metal to provide mirror-smooth friction surface.
- Use care to avoid contaminating friction materials with grease or oil.
- When adjusting brakes after relining with sintered metal, use twice the lining-to-drum clearance that is normal with organic material. This allows sufficient clearance for the metallic part to "grow" as the operating temperature increases.
- Reduce slack adjuster ratios if sintered metal is installed. Air brakes should be used conservatively to avoid excessive application pressures. These will reduce lining and drum life.

Are you letting your trucks run too cool? By not running them at normal operating temperatures you can greatly reduce the life of the

CONTINUED ON PAGE 128A

Michigan SIWA Meets

■ THE 36TH ANNUAL conference of the Michigan Sewage and Industrial Wastes Association was held at Michigan State University, May 31 to June 2, with nearly 300 persons attending.

L. F. Oeming, chief engineer of the Michigan Stream Control Commission, was elected president for the coming year.

In Michigan, long range resource planning includes an investigation of major drainage basin drought characteristics. The Water Resource Commission has studied reservoir sites, wastes assimilation capacity of streams and problems with the Detroit and Rouge Rivers. Annexations are solving metropolitan disposal and treatment problems.

Michigan's first waste stabilization lagoon is at Lawton, others are being planned. A package plant has also been under study in Michigan for 18 months. Other advancements include activated sludge at Birmingham, accelerated sludge digestion and treatment of sewer overflows.

Of mention is that superintendents of municipality-owned treatment plants in Michigan are certified operators and annual training meetings and courses have attracted over 600 operators in 10 years.

A summary was given of 13 months operation of a digester mixer with gas difusers in the tank bottom. Another was given of a sludge mixing investigation into design and sizing requirements. That report included data from 80 plants having sludge mixing equipment.

The economical application on known energy principles and fluid mechanics to the application of digester mixing equipment was illustrated. The Perth gas recirculating system in Pontiac's remodeled digester, installed to help control scum problems, was also described.

Public relations were discussed using a mathematical approach and negative techniques which should not be used.

In a discussion of waste water loadings from commercial and institutional sources, it was decided that design should consider the number of people using the facilities and what they do.

Located in southeastern Michigan, the Huron Basin serves many people, according to one report. It outlined engineering work for developing the basin through 1980, including construction of interceptors and two sewage plants. It was also pointed out that 32 groups organized to coordinate the problem-solving approach. This central group hired consultants, accepted and recommended action on their report.

The use of remote level, pump control and telemetering devices used in some sewage treatment plants was described. The use of common sense in instrumenting flow signals to operate samplers and chlorine feeders was recommended. The need for dissolved oxygen instruments, sludge density control devices, recycle control in trickling filter plants, and air and return sludge control in activated sludge plants was mentioned. Limitations of presently available devices were also mentioned.

Studies are in progress at the University of Michigan of algae growth using a two-compartment culture cell. The studies of algae separation have involved use of a unique, two-way diatomaceous earth filter.

Package sewage treatment plant performance evaluation was made in a description of an experimental oxidation plant installed at Lansing. Data showed removal of 95 percent BOD and 90 percent suspended solids over a four month period in the summer.

Liquid cyclones for waste water degritting were described as efficient hydraulic devices to remove particles up to 150 mesh. The device can also degrit raw sewage, wash detritor underflow and degrit clarifier sludge.

One paper reviewed laboratory experiments at the University of Wisconsin on the effect of extended aeration on volatile solids, effect of dilution medium on BOD of *Chlorella*. Also described was the status of search for a rapid and reliable method for grease determination, use of indicator organisms for pollution detection and flow through characteristics of circular clarifiers when inlet, outlet and volume are changed.

Tolerance level of chromium, copper and nickel in activated sludge was reported. Pilot plant results indicate slug and continuous doses of metal ions do not substantially effect BOD and COD removal, though chromium causes delay in digestion. Copper fed as a sulfate was 75-79 percent removed from primary sludge. Copper fed as 10 ppm copper cyanide seriously interfered with the process, though 68 percent was removed where the dose amounted to 5 ppm.

The effect on the treatment plant of 30 industries on the collection system was illustrated. Variations were plotted showing effect of week-end shut-downs and heavy metal removal by various stages in the plant.

Studies at MSU reveal the presence of viruses (some unidentified), *Enterocci*, strains of *Salmonella*, and *Mycobacteria* in sewage. Elsewhere, reports show evidence of *Shigella*, asiatic cholera, schistosomes and Protozoans. Indications are that infectious hepatitis virus may also be present in sewage. Polio, Coxackie and ECHO virus have each been found in sewage, where chlorination may not be wholly effective, indicating possible presence in downstream water.

Sewage treatment plant employees should exercise good sanitation practices, including immunization where possible, and cleanliness.

Editorial

Unpublished Works

The continuation in this issue of Dale Smelser's article about water losses from distribution systems brings up an interesting question about publication of advanced degree theses. Taking the U. S. academic institutions as a whole, there must be thousands upon thousands of words written each year by candidates for advanced sanitary engineering degrees. As in the case of Mr. Smelser, some of these deal with needs of the future, or propose alternate means of solving current and future problems.

Further, there is bound to be increased effort in this field with an attendant increase in the number of students seeking advanced degrees. One of the recommendations of last year's Conference on Water Pollution was for a prompt increase in "the flow of engineers and scientists . . . at (a) the professional or predoctorate level; and (b) the post-doctorate level". Activity within the academic fraternity reflects this needed and desirable trend. Witness the recent moves to other posts by Drs. Eliasson, McKinney, and others, and by the establishment of new Environmental Health Engineering Centers at Cal Tech and elsewhere. These men and these new approaches to engineer training will swell the forces available to meet future resource problems.

We are not so much concerned about where the students will come from as we are about the ultimate use made of their research reports. Also of concern is whether they will find suitable incentive to work at the municipal level, or will they, as in the case of Smelser, escape to diverse and possibly more lucrative industrial assignments?

It is the disposition of the many theses produced each year in the past and the many to be produced by increased numbers of future candidates that is of current concern. Having completed all academic requirements, the candidate files his thesis with the appropriate department head, and it is often lost as far as future publication is concerned.

We are well aware that bits and pieces about their work are made available through presentations at local and national society meetings. Also, published fragments, such as are contained in our Research Progress Reports, appear from time to time. But by and large, the real bulk of the manuscripts lie comfortably and securely in file cabinets on campuses everywhere.

There are many reasons why some of these documents ought to be more widely published. Publication would start the new graduate out nicely with at least one major literature contribution to his credit, and the published papers list is one of the subtle measurements of the successful professional.

Release of the information for publication might also serve in a small way to prevent duplication. It would also provide substantial means for checking against the methods and results of others. In some cases, the report would enable earlier use of materials or implementation of ideas which could lie dormat for years.

We visualize the eventual solidification of research efforts into a vast coordinated system designed to establish firmly our understanding of basic processes. To be sure, we skirt daily on the fringe of knowing, but we cannot deal indefinitely in this way. Sooner or later we will have to become precise.

An objection to addition of these manuscripts to the already tremendous amount of reading material available would appear to be unfounded. In the long run, assignment of the graduates to municipal positions of responsibility and to staffs of engineers and manufacturers would create a demand for the type of information we have in mind. Thus, some material of the type now submitted for publication could be rejected on the basis of reader interest.

Based on our recent experience with Research Progress Reports and with Smelser's paper, the caliber of material is extremely high. It can also be reported that manuscripts of this type tend to be rather lengthy and often written in complicated and theoretical terms. It is usually possible to reduce the length of an article sufficiently to accommodate it on a series basis. However, to reduce its complexity and eliminate abstract theory becomes more difficult. Perhaps this is because we are dealing with a complicated and highly theoretical subject. And wishing will not make it otherwise.

V. W. Langworthy

A long river crossing was simplified by the use of . . .

Bolted Pipe for an Underwater Sewer

Fig. 1. A 50 FT SECTION of Armco welded pipe being lowered into the Genessee River by the barge mounted crane. Note the two predrilled timber saddles clamped on the pipe.

■ THE CROSSING of the Genessee River which is part of the sewer extension program of the City of Rochester, N. Y. presented several very interesting problems. In the underwater run which is 775 ft long there are several bends. Because of this the L. A. Wells Construction Co. of Cleveland, Ohio which was awarded the contract for the crossing elected to use a combination of bolted joints and long pipe sections for the underwater section.

Bolting of extra-long pipe sections underwater is speeding installation of the sanitary sewer line across the Genessee River near Rochester, N. Y. L. A. Wells Construction Co., Cleveland, Ohio, awarded the river crossing contract by the City of Rochester, felt that a continuous welded pipe would be extremely difficult to lay under these conditions.

Spiral-welded 24 in. pipe sections were shipped to the job in 50 ft lengths with flanged ends. The pipe sections were already lined and coated with coal tar enamel and double wrapped on the outside. A barge mounted crane, equipped with a 75 ft boom, positioned the 0.375 in. wall pipe sections 12 to 40 ft below the surface on timber bents. These bents were spaced 15 and 30 ft on centers.

A typical pier consists of two timber piles, 20 to 40 ft long, driven into the river bottom and capped with 8 x 12 in. timbers. The caps form a base for the pipe's timber saddles.

Installation

Before the crane lowers a pipe length into water, the two shaped saddles are clamped on and predrilled. As each pipe section is lowered over the bents the diver carefully positions the pipe saddles directly on the caps. Using an air drill the diver sinks holes, through the predrilled saddles, into the 8 x 12 in. caps to permit bolting the saddles to the bents.

The diver then uses an impact wrench underwater to tighten the 20 bolts around the pipe flanges. Rubber composition gaskets make this connection watertight.

Scheduled for completion early in 1961 the river crossing contract is an important link in Rochester's Charlotte Hopper-Hollow force main sewer system.

Fig. 2. A DIVER BEGINS his descent to position a pipe section underwater. The diver's underwater work consisted of positioning the pipe on the bent cap, drilling holes in the cap, bolting the pre-positioned saddle to the bent and bolting the sections of pipe together.

WHEN BUYING HYDRANTS LOOK FOR A MANUFACTURER WITH AT LEAST 100 YEARS' EXPERIENCE

Age has its advantages when you are dealing with fire hydrants, because hydrants must provide many years of reliable service. When a manufacturer has been in business 100 years or more, the quality of his product is well known.

R. D. Wood Hydrants have stood the test of time. There are more than a million of them in use right now. This says a great deal for the excellence of the product and the reliability of service.

When you deal with R. D. Wood (over 100 years in the hydrant business) you have the comfortable feeling that we will still be around when your equipment needs service or even replacement.

Conform to A.W.W.A. specifications

R. D. WOOD COMPANY

FLORENCE, NEW JERSEY

Established in 1803

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds)

THIS IS THE R. D. WOOD LINE

R. D. Wood Mathews Modernized Hydrant with replaceable barrel.

R. D. Wood Mathews Flange Barrel Hydrant . . . dry-head construction keeps it operating in every kind of weather.

R. D. Wood Swivel Joint Hydrant can be faced in any direction.

R. D. Wood Gate Valve—bury it and forget it.

Simplified by Simplex: New Float in Flume meter measures with great accuracy the flow of various kinds of liquids in channels, sewers and other gravity flow systems – and radically slashes construction costs.

New "Float in Flume" obsoletes the stilling well – saves you its construction cost

Now you can measure open channel or sewer line flow accurately without a stilling well – but at a fraction of the construction, installation and maintenance costs.

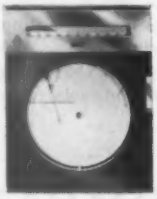
The "Float in Flume" is simplicity itself. A vane, floating atop the liquid passing through the flume, senses the liquid level. This data is transmitted through a Simplex transmitter-receiver system (pneumatic or electric), and is translated into flow terms on a modern, easy to read Simplex type "L" meter.

You save all the costs formerly required by a stilling well: the extra excavation and concrete, float pipe, grating, valves, drain pipe and fittings, cleaning valve and sediment chamber.

You don't even need a purging system. An occasional wiping of the vane is all the cleaning required.

The Float in Flume transmitter may be installed in existing flumes or is furnished assembled with a Simplex Type "S" Parabolic Flume as shown above.

Before you install another meter requiring a stilling well, check the savings of the Float in Flume meter. Drop us a note today and ask for Bulletins 726 and 728.



Simplified by Simplex: New Type "L" Meter is more modern, more compact. Big red-and-white helical indicator replaces pointer, makes reading easier. Continuous type totalizer unsurpassed for accuracy. All parts are mounted on swing-out panel for easy servicing.

SIMPLEX® VALVE AND METER CO.
LANCASTER, PENNSYLVANIA
a division of
PFAUDLER PERMUTIT INC.

Meetings

CONTINUED FROM PAGE 50A

Oct. 25-27—Toledo, Ohio (*Commodore Perry Hotel*) OHIO SECTION A.W.W.A. Secy., J. H. Bass, Henry P. Thompson Co., 4866 Cooper Rd., Cincinnati.

Oct. 25-28—Atlantic City, New Jersey (*Dennis Hotel*) NEW JERSEY SECTION A.W.W.A. Secy., A. F. Pleibel, R. D. Wood Co., 683 Prospect St. Maplewood.

Oct. 25-28—Tacoma, Washington (*Hotel Winthrop*) PACIFIC NORTHWEST WATER POLLUTION CONTROL ASSN. Secy., Gilbert H. Dunstan, P. O. Box 176, Pullman, Wash.

Oct. 29-Nov. 1—Orlando, Fla. (*Cherry Plaza Hotel*) FLA. SEWAGE & INDUSTRIAL WASTES ASSN. Secy., Arthur R. Finney, Jr., 4801 S. W. 117th Ave., Miami 55, Fla.

Oct. 29-Nov. 1—Orlando, Fla. (*Cherry Plaza Hotel*) FLA. SECTION A.W.W.A. Secy., John B. Miller, Director, Div. of Water Supply, Bureau of San Engrg., State Board of Health, Box 210, Jacksonville 1, Fla.

Nov. 1-2—Northhampton, Mass. (*Wiggins Tavern*) NEW ENGLAND WATER POLLUTION CONTROL ASSOCIATION.

Nov. 1-3—Baltimore, Md. (*Emmerson Hotel*) CHESAPEAK SECTION A.W.W.A. Secy., Carl J. Lauter, 6955-33rd St., N. W., Washington, D. C.

Nov. 6-10—Cincinnati, Ohio (*Robert A. Taft Sanitary Engineering Center*) Short Course: Radioactive Pollutants in Water. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

Nov. 8-9—Lincoln, Nebraska (*Hotel Lincoln*) NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN. Secy., E. Bruce Meier, Kirkham, Michael & Assoc., 508 S. 19th St., Omaha 2, Nebr.

Nov. 10—Columbia, South Carolina (*Richland County Health Center*) SOUTH CAROLINA WATER & SEWAGE WORKS ASSN. Secy., Robert N. Bowen, 417 Wade Hampton Bldg., Columbia, S. C.

Nov. 13-15—Ashville, North Carolina (*George Vanderbilt Hotel*) NORTH CAROLINA SECTION A.W.W.A. Secy., T. Z. Osborne, Asst. Director of Public Works, Greensboro.

Nov. 13-17—Cincinnati, Ohio (*Robert A. Taft Sanitary Engineering Center*) Short Course: Radionuclides in Water. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

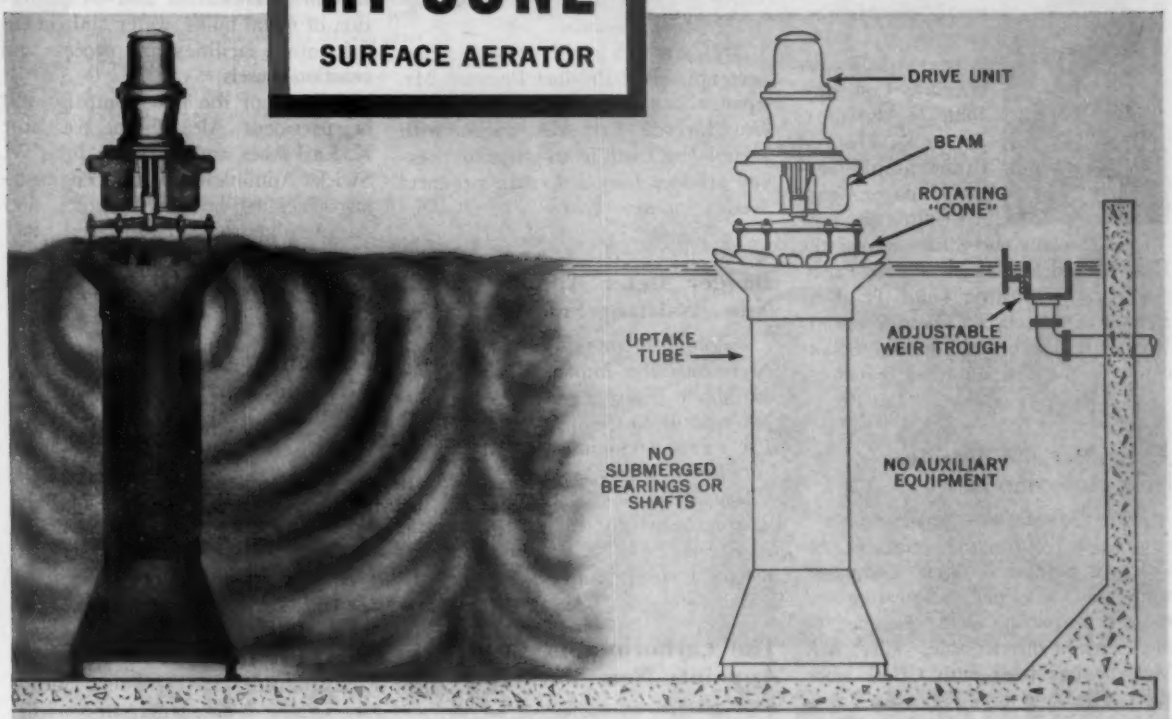
Nov. 15-16—Indianapolis, Ind. (*Hotel Washington*) INDIANA SECTION SEWAGE & INDUSTRIAL WASTES ASSN. Secy., Victor G. Wagner, State Dept. of Health, 1330 W. Michigan St., Indianapolis 7, Ind.

Nov. 21—New York, N. Y. Midyear Conference of Manufacturing Chemists' Assn., Inc.

Nov. 27-Dec. 1—Stillwater, Oklahoma (*Oklahoma State University*) OKLAHOMA WATER, SEWAGE & INDUSTRIAL WASTES CONF. Secy., M. H. Crane, 3400 Northeastern, Oklahoma City 5, Okla.

TRUE EFFICIENCY WITH FLEXIBILITY

HI-CONE®
SURFACE AERATOR



Units for ALL Sizes of Waste Treatment Plants

THE TRUE EFFICIENCY of any type of sewage aerating equipment is best measured in terms of oxygen dissolved into the sewage, not air "delivered" to it. Until the oxygen is in solution, it is not available to the aerobic organisms responsible for purification.

As a result of recent investigations, it is becoming increasingly apparent that oxygen absorption is almost entirely dependent on the rapid and continuous creation of liquid-to-air interfaces. This fact has been long known but not forcibly demonstrated until recently. All oxygen absorption occurs at the liquid "surfaces"—regardless of equipment design or method of aeration.

Therefore, the gauge of efficiency, whatever type of equipment you consider, is "lbs. of oxygen absorbed per KWH."

Compare Hi-Cone's "efficiency rating" with any other aeration equipment. At the same time, investigate the ease with which Hi-Cone handles variations in waste flows and strength through easily adjustable weirs and variable operating speeds. You can get this information by asking your Yeomans representative or the factory for the studies offered at right.

TYPICAL FLEXIBILITY AND EFFICIENCY OF NO. 70 HI-CONE (OXYGENATION CAPACITY—20° TAP WATER)

Inches of Cone Exposure	R.P.M.	Lbs. O_2 Absorbed per Hour at 20° C	NET KW	NET KWH per Lb. Oxygen Absorbed
½	34	37.2	7.0	.188
½	42	57.5	9.9	.172
2	38	38.7	7.3	.189
2	46	54.0	10.0	.185
4	34	27.7	4.9	.177
4	50	54.0	9.5	.176

YEOMANS
1999-9 N. Ruby St., Melrose Park, Illinois
WASTE HANDLING SPECIALISTS FOR OVER 60 YEARS

Now Available! Basic Data For Evaluating Aeration Equipment

- ☐ Activated Sludge Plants
- ☐ Aerobic Digestion Plants
- ☐ Aerator Performance Studies

H-6139

News of Suppliers

J. H. Kilmer New President of Golden Anderson Co.

At the recent annual stockholders meeting of Golden-Anderson Valve Specialty Company, John H. Kilmer, Jr., was elected President and General Manager. Grant A. Colton is now Vice-President and Chariman of the Board, Paul B. Brauer is Vice-President and Treasurer, and H. Carl Brandt is Secretary. These four plus Robert E. Colton and Edwin Elliott comprise the new Board of Directors.

J. S. McCabe Receives New Assignment

John S. McCabe has been appointed a contracting engineer by Chicago Bridge & Iron Company, world wide steel plate fabricating and construction firm. He is assigned to the Chicago district sales office. Mr. McCabe has been with CB&I since 1955. His first assignment was as a field engineer in the Houston Erection district.

Fischer & Porter Co. Appoints R. E. Eisele as Assistant Advertising Manager

Fischer & Porter Company, manufacturers of automatic data reduction and process control instrumentation, chlorination and chemical feed equipment, and laboratory glass ware, has appointed Robert F. Eisele as Assistant Advertising Manager. Mr. Eisele will be located at the firm's headquarters in Warminster, Pa.

Henry Pratt Co. Makes Two Important Appointments

Henry Pratt Co. of Chicago has recently announced two important assignments. Mr. William W. Gordinier has been named Manager of Industrial Relations. Previously he held a similar position with Chapman Valve Manufacturers Co. of Springfield, Massachusetts.

Mr. Frederick M. Spaugh has been appointed Product Planner. Mr. Spaugh was previously with the General Electric Co. His duties with Henry Pratt will be to integrate present product lines and plan products needed for new areas.

Badger Meter Appoints New Assistant Sales Manager

Ralph E. Moon has been appointed Assistant Sales Manager of the Water Meter Division of Badger Meter Manufacturing Company, Milwaukee. The recent announcement was made by Ross J. Burns, Vice President.

Mr. Moon has been employed by Badger Meter for the past 15 years as Special Sales Representative and also as Export Manager.

The Carborundum Co. Appoints New Marketing Executive

Mr. Robert W. Lear, director of marketing services, American Radiator and Standard Sanitary Corporation, New York City, has accepted the position of vice president in charge of marketing for The Carborundum Company, Niagara Falls, New York, according to an announcement by General Clinton F. Robinson, president of Carborundum.

Technical Team to Seek New Building Products

The appointment of four new managers in its reorganized technical department has been announced by Allied Chemical's Barrett Division as part of an intensified program of building materials research and development.

Joseph W. Donegan has been named manager of technical service; Richard K. Eberts, manager of development research; Robert L. Harris, manager of laboratory research; and Frank P. Maxwell, manager of development engineering.

Dorcon Formed to Manufacture Tanks and Vessels

Dorcon Incorporated, a wholly-owned subsidiary of Dorr-Oliver Inc., Stamford, Conn., is being formed to engage in the design, manufacture, fabrication and field erection of metal tanks, water and chemical storage facilities, and process and reaction vessels.

Officers of the new company will be president Alex Fino, treasurer K. Earl Abel, and secretary John W. Swick. Administrative and engineering offices will be at Warren Pa., and sales headquarters in Pittsburgh, Pa., with Max G. Walker as sales manager.

Fairbanks, Morse Names Director of Public Relations

A. Conant Moulton has been appointed director of public relations of Fairbanks, Morse & Co., Yonkers, N. Y., it was announced by President Thomas G. Lanphier, Jr.

Moulton joins F-M from General Dynamics Corporation, New York, where he was director, information services. Before he was manager of the corporation's aviation public relations.

R. E. Lambert Promoted by Link-Belt Co.

Roy E. Lambert has been appointed general manager of the Link-Belt Company Bearing Plant in Indianapolis, it was announced by Robert C. Becherer, Chicago, president. Mr. Lambert succeeds Raymond S. Wood, who is retiring from the company after 47 years of service.

Mr. Lambert joined the company in 1937 at the Dodge Plant in Indianapolis, predecessor to the new Bearing Plant. In 1945 he was named ball and roller bearing specialist for the Chicago district. He returned to the Dodge Plant in Indianapolis in 1951 as assistant general superintendent. He was named production superintendent in 1958 and assistant general manager last year.

CONTINUED ON PAGE 104A

WALKER PROCESS EQUIPMENT AT THIS PLANT INCLUDES . . .

grit collector and conveyor; Sparjair diffusers for grit aeration, pre-aeration, activated sludge aeration, re-aeration and holding tank aeration; eleven Airopump air lift pumps for return activated sludge; three Gaslifters for digester circulating; a digester gas holder and two Multi-draw, suction type final tank collectors with corner sweeps.

Mansfield, Ohio's modern sewage treatment plant was dedicated in October 1960. With present population exceeding 51,000, plant design is based upon a 1980 population of 110,000; with provisions to expand to handle 220,000.
Floyd G. Browne & Associates, Marion, Ohio—Consulting Engineers
George W. Cunitz, City Engineer
Lawrence E. Rigby, Plant Superintendent

...Walker Process sewage, water and waste treatment equipment

Consulting Engineers, in designing modern treatment facilities, have found that Walker Process offers one of the most complete selections of process equipment in the sanitary engineering field. Walker Process engineers and manufactures treatment units to handle every phase of modern sewage treatment processes. Similarly, equipment for iron removal, sedimentation, mixing, flocculation, softening, turbidity removal, and carbonation is offered for water treatment. Specially developed industrial units are also available for solids-in-liquids recovery and/or waste problems. Through sound engineering, continuing research and up-to-date manufacturing methods, Walker Process has contributed many improvements and new developments. SPARJER aeration units, GASLIFTER digester gas-lift mixers, CARBALL CO_2 producers, CLARIFLOW clarifiers and SPARJAIR compact sewage treatment plants are but a few of the exclusive Walker Process developments for which they are renowned. Write for complete information. Sales-Engineering representatives are located throughout the U. S., Canada, Mexico, New Zealand, Australia and Japan.

WALKER PROCESS

Walker Process Equipment Inc.

FACTORY • ENGINEERING OFFICES • LABORATORIES • AURORA, ILLINOIS

News of Suppliers

CONTINUED FROM PAGE 102A

H. DeForest Hardinge Appointed Vice President Hardinge Co., Inc., and Hardinge Mfg. Co.

H. DeForest Hardinge was appointed Vice President, Hardinge Company, Incorporated, and Hardinge Manufacturing Company, during a recent Board of Directors' meeting.

Mr. Hardinge is a graduate of Deerfield Academy and Cornell University and also received his Master's degree from the Cornell Graduate School of Business and Public Administration.

W. A. Welch Joins Carus Chemical Co.

W. Arthur Welch has joined Carus Chemical Company, Inc., LaSalle, Illinois, as Technical Consultant, it was announced by S. Bruce Humphrey, Director of Marketing.

Mr. Welch will assist customers in the application of Carox (T.M.) potassium permanganate for the solution of water purification problems involving tastes and odors, iron and manganese.

Known in the water purification and chemical processing industries for many years, Mr. Welch holds a Master's degree in organic chemistry from the University of West Virginia. He has contributed extensively to the technology of taste and odor control, a phase of water purification in which he has been active for the past 25 years.

B-I-F Now Division of New York Air Brake

B-I-F Industries, a leader in automatic flow control, measurement, and weighing of gases, liquids, and solids, and specialists in providing equipment and engineered systems for many process industries, as well as water works and sewage and industrial waste treatment plants, announces that negotiations have been completed, and that B-I-F is now a division of The New York Air Brake Company.

B-I-F Industries continues in Providence, R.I., under the same operating management and with no change in aims or objectives. As a member of The New York Air Brake family, B-I-F is now associated with Aurora Pump, Aurora, Ill.; Feedback Controls, Natick, Mass.; Kinney Vacuum, Boston, Mass.; and expanding operations in The New York Air Brake facilities in Watertown, N. Y.

G. E. Smith Promoted at Airkem, Inc.

Gerard E. Smith has been promoted to Vice President in Charge of Sales-WESTERN HEMISPHERE, and has been elected to the Board of Directors of Airkem, Inc., at the Company's Board Meeting in its New York Headquarters, 241 East 44th Street, New York City.

Lock Joint Acquires Oscar Davis Company

Lock Joint Pipe Company, leading producer of concrete pipe, today announced the acquisition of Oscar Davis Company, Inc., Paterson, N. J. This latest addition to Lock Joint's recently formed Plastics Division is a fabricator of rigid PVC (polyvinyl chloride) valves, fittings, and other specialties.

Two Executive Changes at Leeds & Northrup

Two executive changes at Leeds & Northrup Co., manufacturer of automatic controls, measuring instruments and furnaces, have been announced by I. Melville, Stein, president.

Alexander H. Reynolds, Jr., presently treasurer, was elected a vice president and will be responsible for long range planning.

Stephen Loidl, Jr., presently controller and manager of the accounting division, becomes treasurer and controller, with direction of all Financial Department operations.

Hagan Chemicals Appoints Manager of Public Relations

Albert M. Gaber has been named Manager of Public Relations for Hagan. Chemicals & Controls, Inc., Pittsburgh, Pa. In this position he will be responsible for public relations and product information concerning Hagan's consumer products, industrial chemical products, control equipment and consulting services.

E. E. Swansen Promoted at Chain Belt Co.

The appointment of Earl E. Swansen as manager of product planning and development has been announced by the conveyor and process equipment division of Chain Belt Company, Milwaukee.

In his newly-created position, Swansen will coordinate the division's product planning and product development program, and will also be responsible for the improvement of existing product lines. Swansen joined Chain Belt in 1949.

A. J. Buford Named K&M Merchandising Manager

Andrew J. Buford, of St. Louis, has been named merchandising manager for agent sales in Keasbey & Mattison Company's asbestos-cement pipe sales division at Ambler, Pa., it was announced by J. R. Reichel, general manager pipe sales division. Buford, previously was a salesman for K&M pipe in the St. Louis area. He is a graduate of St. Louis University.

Dow Declares Dividend

The Board of Directors of The Dow Chemical Company, declared a dividend of 40 cents per share on its common stock payable Octiber 14, 1961, to stockholders of record at the close of business on September 15, 1961.

Dow increased its dividend to 40 cents per share from 35 cents which has been quarterly since January, 1960.

CONTINUED ON PAGE 106A

NEW F-M

NON CLOG SUBMERSIBLE PUMPS

Now! A sewage pump that's not only **non-clogging**—but so easy to install, you actually just "plug it in!" This flexibility plus the non-clogging feature gives you a pump that keeps ahead of any waste removal emergency! Our new, NON-CLOG SUBMERSIBLES are compact, sturdy, and rigidly designed to **stand firm!** And—they can't flood out, under any condition! F-M NON-CLOG SUBMERSIBLE PUMPS are available in 2, 3, and 4-inch sizes—with motors from ¼ HP to 7½ HP. They're your best buy . . . by far!

HANDLES HEAVY SLUDGE, SLURRIES: Patented, non-clog impeller permits passing liquids containing solids many times the size conventional pumps handle.

EASILY INSTALLED, MOVED: Simple design and installation permits submerged "hook-ups" quickly, easily. Needs only one water-tight plug-in, one pipe.

VERSATILE APPLICATION: Any industrial waste removal system can be expanded, made more flexible! Ideal for storm water drainage, small sewer lift stations—**any** installation using submersible pumping!

Fairbanks Morse makes NON-CLOG PUMPS in a wide variety of frame combinations and sizes: Biltogether, Vertical Close-Coupled, Gear or Motor Driven, Open and Flexible Shaft Drives for dry pit service, with Open or Bladeless Impellers. For further information on a NON-CLOG PUMP designed specifically for **your** installation, write: **Pump & Hydraulic Division; Fairbanks, Morse & Co.; Kansas City, Kansas.**

FAIRBANKS MORSE

A MAJOR INDUSTRIAL COMPONENT OF

FAIRBANKS WHITNEY

News of Suppliers

CONTINUED FROM PAGE 104A

Deming Pump Becomes Division of Crane Co.

Crane Co. has announced the purchase of substantially all the assets of the Deming Company, Salem, Ohio.

Deming, one of the best known pump manufacturers in the United States, was founded over 100 years ago. Its sales of pumps and water systems to industry, farms and homes have averaged more than $10,000,000 for the past several years.

D. C. Fabiani, Executive Vice President of Crane Co., said that the addition of Deming's extensive manufacturing facilities in Salem, Ohio; Rogers, Arkansas and Monterrey, Mexico will permit Crane Co. to enter the industrial pump business for the first time in the United States and Mexico.

L. K. Lukity Named Technical Superintendent of Hamilton Kent

Appointment of Louis K. Lukity to the post of Technical Superintendent of Hamilton Kent Manufacturing Company, has been announced by T. S. Rowe, President.

Mr. Lukity, a native of Ohio, has 24-years of experience in industrial rubber compounding, product development, and rubber products manufacturing. He comes to Hamilton Kent from Dryden Rubber Division of Sheller Manufacturing Co., Chicago, where for years he held posts in rubber research and development departments of the company. Previous to Dryden Rubber, Lukity worked in similar capacities for Faultless Rubber Co., Ashland, Ohio, and B. F. Goodrich Co., Akron, Ohio.

Dr. Gunyou to head Neptune Research and Development

Dr. E. B. Gunyou has been named Director of Research and Development of Neptune Meter Company, according to an announcement made by W. H. Cochrane, President.

Dr. Gunyou has been associated with Alco Products, Curtiss-Wright Corp. and Vitro Corp. of America in various technical capacities. He is a graduate of Ohio State University, received his doctorate in 1940, and is a member of AIChE and the American Chemical Society.

F. Marold Promoted by Griffin Pipe Division

Mr. S. C. Prest, Vice President and General Manager of the Griffin Pipe Division, Griffin Wheel Company announced that Mr. Frank Marold has been appointed Vice President and Assistant General Manager.

Mr. Marold joined the Griffin Wheel Company in March 1959 as Sales Vice President. Prior to that time, Mr. Marold was a Marketing Consultant to the Griffin Wheel Company and was also formerly associated with the Warren Foundry and Pipe Division of New York and the Allis Chalmers Mfg. Co. of Milwaukee.

New Sales and Service Representatives for P.F.T. Co.

The Pacific Flush Tank Company, Chirago manufacturers of waste treatment equipment, announce the following new sales and service representatives: DeLaval Turbine Pacific Company with offices in Millbrae and Sacramento will represent the Chicago firm in Northern California.

Another new appointment by the Chicago firm was that of Mr. James MacNichols, Mr. Earl Ivins and Mr. John Sidle of Engineers Sales-Service Company, Inc., Los Angeles. They will handle sales and service for P.F.T. in the Southern half of California.

P.F.T. representatives for the Northwest region were named with the H. D. Fowler Company, Seattle, Washington being the new sales and service office. This office will serve Washington, Oregon, Montana, Northern Idaho, British Columbia and Alaska.

E. A. Gaudette Appointed Vice President and Treasurer of Neptune Meter

W. H. Cochrane, President of Neptune Meter Company, has announced that Edgar A. Gaudette has been appointed Vice President and Treasurer of the company. Mr. Gaudette had formerly been Assistant to the President in charge of the financial and accounting operations of Neptune, its divisions and subsidiaries.

J. McWhirter Elected Vice President of Pennsalt Chemicals

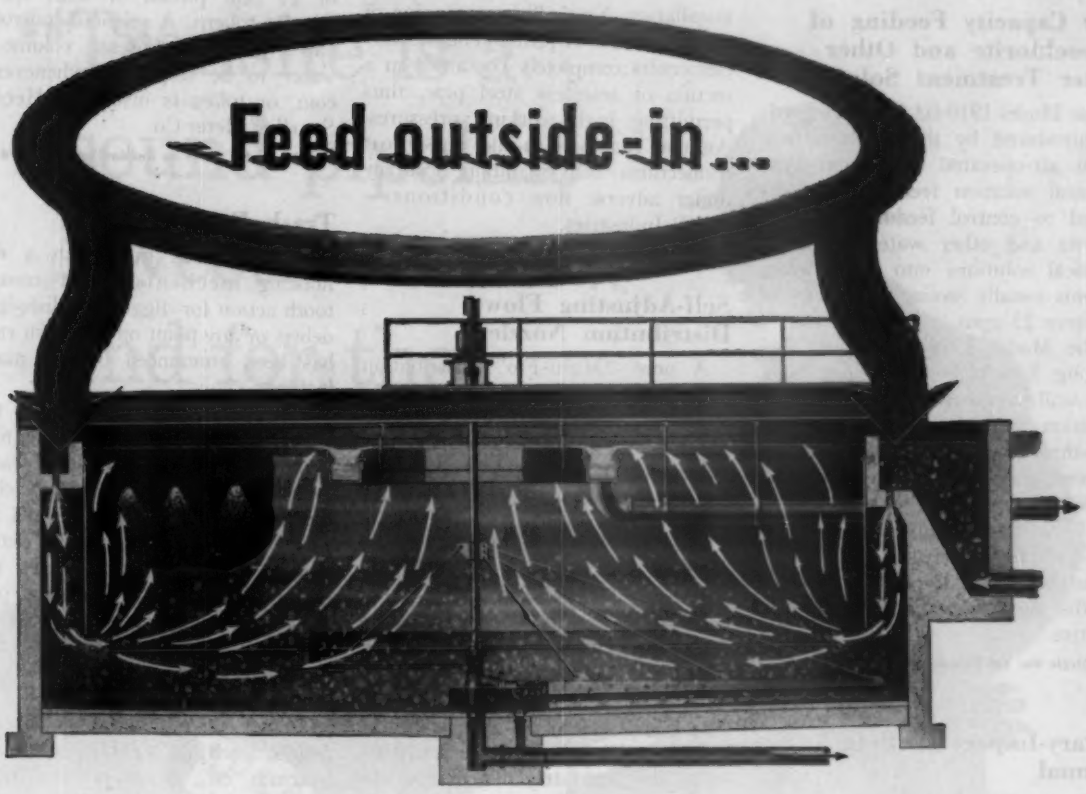
James McWhirter, General Manager of Industrial Chemicals Division, Pennsalt Chemicals Corporation, has been elected a Vice President of the Company. The announcement was made by William P. Drake, President.

Since becoming associated with the firm in 1945, he has successively served as Plant Superintendent at Natrona, Pa., Calvert City, Ky., and Wyandotte, Michigan. In 1952, when Sharples Chemicals Inc. merged with Pennsalt, he was appointed Manager of Manufacturing for the newly-formed Industrial Chemicals Division-East. Because of his long experience with manufacturing and personnel functions, he was named Director of Personnel in 1958. He assumed his present post as General Manager of Industrial Chemicals Division-East in 1960.

Eimco Names Regional Sales Agents

The Eimco Corporation has announced the appointment of the Dravo Corporation's Machinery Sales Department at Pittsburgh, Pennsylvania as agents in that area for sanitary and industrial process and filter equipment produced by Eimco's Process Engineers and the company's Filter divisions.

See the Rim-Flo Model Unit in action at Booth Nos. 29 and 30 at the Water Pollution Control Federation Show in Milwaukee.



to DOUBLE clarifier capacity

That's the capacity-adding difference between the exclusive Rex Rim-Flo Clarifier and conventional circular center-feed tanks. In Rim-Flo, the flow is introduced into a feed channel around the enitre periphery of the tank. The feed channel is hydraulically sized to provide uniform velocity of flow and to prevent depositing of solids in the channel bottom. The flow is then uniformly introduced into the tank through properly sized and spaced orifices in the channel bottom...each orifice taking its proper share of the total flow.

The influent entering the tank is distributed evenly between the outer tank wall and the baffle skirt. This area serves to reduce the effect of discharge through the ports so that the flow approaching the tank bottom is well diffused and at lowest possible velocity.

Because of this thorough diffusion and low velocity, harmful eddy currents and short-circuiting are practically eliminated. The flow moves gently throughout the entire tank cross section utilizing virtually the entire tank volume. Flow is directed upward to the center of a central effluent trough.

This proven principle will handle at least double the flow of a conventional tank...provide maximum efficiency. Why not get all the facts today. Write CHAIN Belt Company, 4610 W. Greenfield Ave., Milwaukee 1, Wis.

REX®
CHAIN BELT COMPANY

Equipment News

CONTINUED FROM PAGE 26A

Low Capacity Feeding of Hypochlorite and Other Water Treatment Solutions

The Model 1910-02 Chem-O-Feeder introduced by this manufacturer is an air-operated diaphragm type chemical solution feeder. It is designed to control feeding of hypochlorite and other water treatment chemical solutions into small water systems usually having a capacity of not over 25 gpm.

The Model 1910-02 is only 7⅜ in. long, 5 in. wide and 5¾- in. high. It is wall-mounted for convenient installation and features a transparent "see-through" head of molded, stress-relieved plastic. Operating from air or water pressure (10 to 70 psi), the 1910-02 will deliver from 1.9 to 22.8 gallons per 24 hours. Rates are adjustable by varying of stroke lengths and frequencies.—B-I-F Industries.

Circle No. 1013 on Reader Service Card

Rotary-Impact Drilling Manual

The ROTO-IMP Tool Division of Bill Jack Scientific Instrument Co. offers a new manual entitled "How to Use the ROTO-IMP". This 20-page booklet illustrates and explains methods and techniques for drilling holes up to 6 inches in diameter in reinforced concrete with ROTO-IMP tool.—ROTO-IMP Tool Div., Bill Jack Scientific Instrument Co.

Circle No. 1014 on Reader Service Card

Venturi Flow Nozzle, Welded Insert Type for High Pressure, High Temperature Services

B-I-F's Venturi Flow Nozzle, Welded Insert Type, Model 134, is a differential producing primary flow metering element for service such as encountered in steam generating plants, petroleum-product pipe lines and refinery applications. It is described in a new specification data bulletin just issued by this manufacturer.

The Venturi Nozzle is provided with ends beveled or flanged for easy installation. No drilling or tapping of the pipe line is required. The Venturi element is completely contained in a section of seamless steel pipe, thus permitting high working pressures. Annular chambers at inlet and throat connections help maintain accuracy under adverse flow conditions.—B-I-F Industries.

Circle No. 1015 on Reader Service Card

Self-Adjusting Flow Distribution Nozzle

A new "Multi-Flo" distribution nozzle for Reaction Distributors, which automatically adjusts to the sewage flow is announced by this manufacturer. This new nozzle greatly increases the efficiency of

Reaction Distributors by automatically and accurately distributing the sewage flow throughout a wide range under variable hydraulic heads without spreader plates, over-flow controls or speed retarding devices; also provides the economy of two arm construction in many installations.

By automatically enlarging or reducing the size of the nozzle opening, a greater variation of flow can be discharged at a lower hydraulic head, therefore the rotational speed of the distributor is automatically controlled. This feature will usually eliminate need for speed retarding devices otherwise required to insure proper distribution of the liquid on the filter bed.—The American Well Works.

Circle No. 1016 on Reader Service Card

Coin-Operated Dispensing Meter

A coin-operated dispensing meter for use where there is intermittent or sporadic water consumption, has been announced by this manufacturer. The unit features a 6-digit straight-reading totalizer for permanent record of all flow.

Delivery quantities may be regulated in volumetric units from 100 to 10,000. Remotely located coin box is furnished to accommodate 5, 10, or 25 cent pieces, or with special box for tokens. A solenoid-controlled valve permits a preset volume of water to be dispensed whenever a coin, or token is inserted.—Hersey-Sparling Meter Co.

Circle No. 1017 on Reader Service Card

Trash Rake

A new trash rake with a dual hoisting mechanism that controls tooth action for digging or dislodging debris or any point on the trash racks has been announced by the manufacturer.

The new unit is designed so that when the rake is lowered, its teeth point downward and parallel to racks. When the bottom position is reached, the teeth turn inward toward the trash rack with a digging action, thereby providing an effective raking position for a cleaning pass. Upon reaching the top position above the trash apron and car, the rake teeth are tilted and the debris is dumped.

Where heavy, dense or floating debris, such as tumbleweed, water hyacinth, etc., is encountered in the water intake, the rake can be lowered so that the teeth penetrate the debris and tear it apart. The main hoist then pulls the rake and its load of trash back up.—Allis-Chalmers Mfg. Co.

Circle No. 1018 on Reader Service Card

Sewage Treatment Plant

A new sewage treatment plant, designed to be field-erected at the job site, has been announced by this manufacturer.

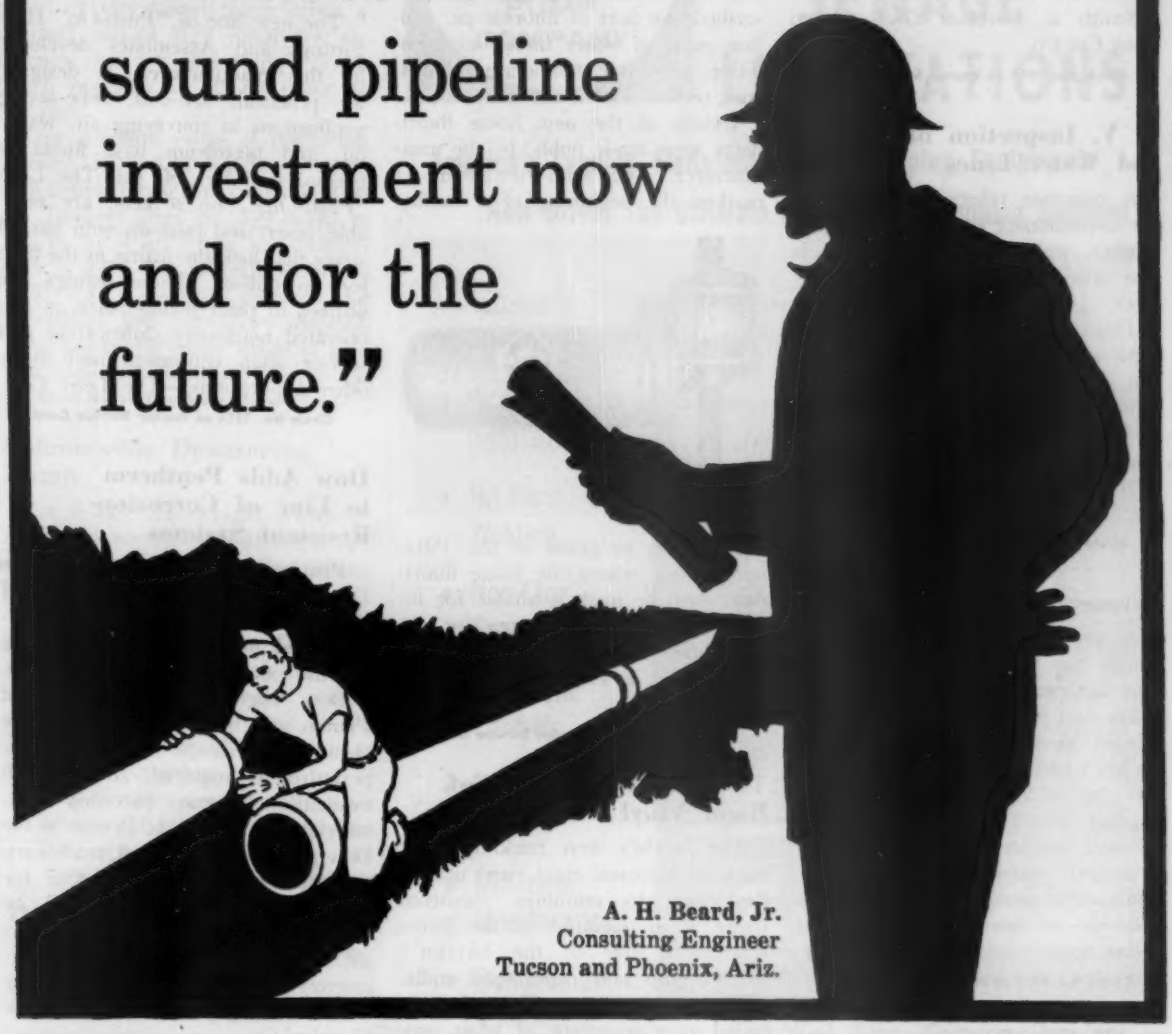
The new unit, Model R "Oxigest", will be fabricated in 17 sizes from 30,000 to 500,000 gallons per day, to serve small communities, subdivisions and other facilities from 300 to 5,000 persons.

The manufacturer will supply, assemble and erect the Model R unit on the purchaser's foundation with all material and equipment necessary for a complete, ready-to-operate sewage treatment facility. Under normal conditions, the purchaser will be responsible for the excavation, founda-

CONTINUED ON PAGE 110A

An engineer from Arizona reports:

"Transite is a sound pipeline investment now and for the future."



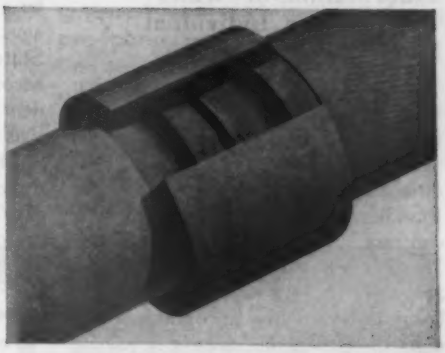
A. H. Beard, Jr.
Consulting Engineer
Tucson and Phoenix, Ariz.

"When considering a pipe material for water and sewage projects, 'value' analysis plays an important part in our choice. One of the main questions is whether the pipe will perform reliably now *and* in the future with cost advantages to the client.

"Experience has shown that Johns-Manville Transite® Pipe offers the value we seek. It has proved reliable and at very favorable costs. In addition to savings in handling and installing, Transite's unique Ring-Tite® joints assure that leakage tests will not upset job costs. In numerous tests, Transite lines have regularly been under the 'allowable' specification.

"Installations as old as Transite itself show this pipe outstanding under flexure, crush and hydrostatic conditions. Lengths of Transite excavated here in Arizona for tests showed no signs of internal corrosion after 20 years of dependable service."

For full details, write to Johns-Manville, Box 362, WS-10, N. Y. 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.



JOHNS-MANVILLE JM

Equipment News

CONTINUED FROM PAGE 108A

tion slab, backfilling, inlet and outlet sewer connections and power supply to the electrical control panel. —Smith & Loveless Div.,—Union Tank Car Co.

Circle No. 1019 on Reader Service Card

T. V. Inspection of Sewer and Water Lines

A complete television system for the inspection of sewers, water lines, conduit, wells, water tanks, etc., is now available from this manufacturer.

This water tight system is complete with an enclosed lighting system, 500 or 1100 ft of cable, and generator. The system is capable of being pulled through pipelines as small as 4 in. in diameter and as large as 48 in. in diameter.—Inspectoline Inc.

Circle No. 1020 on Reader Service Card

Submersible Pumps

A new line of 8 in. submersible pumps has been announced by this manufacturer.

The new Series F pumps are available in sizes from 10 hp through 50 hp with a capacity range from 150 gpm to 550 gpm in three basic impeller sizes. They are well suited to meet industrial, commercial and municipal water supply requirements. The pumps can be used in wells or as horizontal or vertical in-line boosters.—Sumo Pumps, Inc.

Circle No. 1021 on Reader Service Card

Fluoridation of Water Possible for Individual Families

A small, foolproof device that makes fluoridation of water possible for individual families, has been developed by Permutit Water conditioning, Inc., a subsidiary of Pfaudler Permutit, Inc. under a contract with the U. S. Public Health Service. The new device is about the size of a ½ gal jar and is attached to the incoming water pipe of the home, where it accurately feeds the small amount of fluoride necessary for prevention of dental cavities. Extensive service operation of the home fluoridator at the Permutit Laboratories has proved that the device will meter the prescribed one part of fluoride per million parts of water under any condition of water temperature, pressure, or flow.

Details of the new home fluoridator were made public by the manufacturer. The announcement marked the beginning of a market

introduction program in the Pittsburgh area, where the home fluoridator will be made available for installation in private homes for the first time. Permutit Water Conditioning Inc. a subsidiary of Pfaudler Permutit Inc.

Circle No. 1022 on Reader Service Card

Trickling Filter Made of Rigid Vinyl Plastic

The world's first trickling filter made of Koroseal rigid vinyl plastic, designed to minimize industrial waste, is in operation at the Rome Kraft Co., one of the nation's largest pulp and paperboard mills.

The new trickling filter plant is hailed as a prototype of what may be a solution to critical water shortages expected to afflict the United States during the next 20 years, according to P. W. Perdriau, president of the B. F. Goodrich division that manufactures the vinyl material.

The new 100,000 cu ft plant is three stories high and contains about 370,000 lbs of rigid Koroseal vinyl preformed into 6,250 filtercomb-like units or packs, manufactured by B. F. Goodrich Industrial Products Co.

Perdriau said, that while this first vinyl-cored plant was designed specifically for pulp and paper waste, the same principle shows great promise for municipal sewage treatment and in other industries where the bacterial oxidation is needed.—B. F. Goodrich Industrial Products Co.

Circle No. 1023 on Reader Service Card

"Push-On" Hose Fittings

The new line of "Push-On" Hose Fittings and Assemblies developed by this manufacturer, is designed for practical, low-cost, time-saving applications in conveying air, water, oil, and petroleum base fluids at pressures under 250 psi. The Lenz "Push-Ons", no sockets, are reusable, insert and push-on with barbed stems that lock the fitting in the hose for no pull-on. These fittings are utilized in plant maintenance, in air-operated machinery, lubrication and service shop equipment and many other applications.—The Lenz Co.

Circle No. 1024 on Reader Service Card

Dow Adds Pentherm to Line of Corrosion-Resistant Systems

Penton has joined saran in The Dow Chemical Company's line of corrosion-resistant pipe, valves, fittings and pumps. Dow's trademark for the new products is Pentherm.

Dow engineers said linings of Penton will be recommended where chemical resistance at higher temperatures is required. A 30-month evaluation program preceded commercial introduction of Penton in the Dow product line. Penton, trademark of The Hercules Powder Co. for its chlorinated polyether, will be used as a liner for corrosion-resistant systems—as is saran. Inside diameters will be the same as for saran lined products.—The Dow Chemical Co.

Circle No. 1025 on Reader Service Card

End Loader

A new 3000 lbs capacity End Loader has been added to this manufacturer's line of All Wheel Drive 42 hp tractors.

Model 44-35 Tractor Loader combination is able to operate in mud, snow, sand and all adverse ground conditions.

Operating features include self-leveling bucket, positive fast double acting hydraulics, vane type pump, 42 in. of reach, and maximum dump angle of 48 degrees with 8 ft under

the bucket lip. Bucket sizes available other than standard ¾ yd materials bucket.—Detroit Tractor Ltd.

Circle No. 1026 on Reader Service Card

Triplex Plunger Pump

A new pump, the PT-4, introduced by this manufacturer offers a compact unit of high volumetric efficiency. It is a triplex plunger pump which operates at 70 hp input at 400 rpm.

Low pressure range of the pump is from 510 psi to 1563 psi, while high pressure range maximum is 3000 psi. Plunger sizes are 3½ down to 1¼ in. by 4 in. stroke and plunger load is 4910 lbs. Overall weight is 1370 lbs. Especially designed for waterflood and salt water disposal, these pumps fill many needs in general industry.—Gardner-Denver Co.

Circle No. 1027 on Reader Service Card

Submersible Dewatering Pump

An 8-inch Submersible Dewatering Pump, identified as Model S8A1, is now available from this manufacturer.

The capacity ranges from 1000 gpm at 148 ft head to 2700 gpm at 40 ft head. It has an oil filled motor housing for increased cooling and dual seals that run in oil. Height is 31 in., diameter 28 in. Aluminum construction reduces weight to 775 pounds. Strainer area is 480 square inches with 1 inch square openings. —The Gorman-Rupp Co.

Circle No. 1028 on Reader Service Card

Oxidation Plant Has Comminuting Pump Screen

This Manufacturer's Oxy-Pak fully automatic, total oxidation plants feature a new arrangement of a recently developed comminuting pump screen with "Aircomb" non-clog diffusers.

The screen is suited for small and medium size plants and is designed to be practically care-free. In case of power failure, the flow will continue through the bar screen which is an integral part of the system.

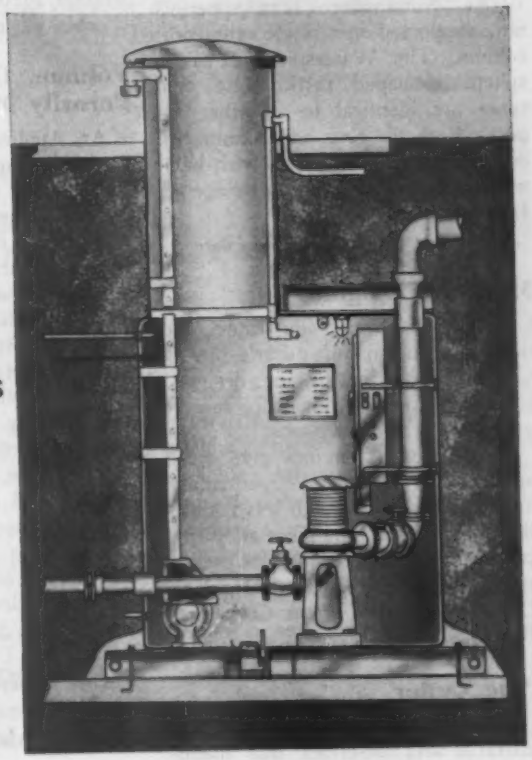
In operation, flow entering the aeration tank is immediately mixed with the raw sludge and return sludge. The self-adjusting orifices of the "Aircomb" eliminate the danger of clogging.—American Well Works.

Circle No. 1029 on Reader Service Card

weil PUMP COMPANY

FACTORY ASSEMBLED SEWAGE LIFT STATIONS

America's Leading Manufacturer Of Pumping Equipment
Now Offers The Ultimate In Packaged Pumping Stations



- Automatic Operation
- One Day Installation
- No Field Welding
- Non-Clog Sewage Pumps
- Automatic Controls
- Floodproof Station
- Minimum Maintenance
- Dehumidified Ventilation
- Completely Guaranteed

Weil Pump Company has engineered and manufactured a pre-fabricated sewage lift station to meet your specifications and demands. All the finest Weil equipment; factory assembled, pre-wired, tested and delivered to your site ready for fast, easy installation.

Send for BULLETIN NO. LS 2200

weil PUMP COMPANY

1532 NORTH FREMONT STREET, CHICAGO 22, ILLINOIS

New Literature

AVAILABLE FREE

Elevated Water Tanks

16-page brochure illustrates and describes this manufacturer's Modern elevated water tanks identified as the "Watersphere" and the "Waterspheroid." The first one is built in capacities from 25,000 to 250,000 gallons; the second one, in capacities from 200,000 to 500,000 gallons.

The Watersphere is a spherical tank supported on a single cylindrical column. The Waterspheroid has a spheroidal-shaped tank. The two types are identical in all other aspects. Both the tank and column are constructed of steel plates with butt-welded joints.—Chicago Bridge & Iron Co.

Circle No. 1030 on Reader Service Card

Municipal Engines

4-page brochure illustrates and describes this manufacturer's line of Climax® Municipal Engines designed to provide low cost power for sewage and water treatment plants.

These rugged engines give quick acceleration, withstand overloading, and perform longer with less maintenance. The rigid, one-piece alloy iron crankcase is heavily ribbed for greater strength.—Climax Engine Mfg. Co., Div. of Waukesha Motor Co.

Circle No. 1031 on Reader Service Card

Pipe Cutter

Catalog and price list No. 42 illustrates and describes this manufacturer's heavy duty Pipe Cutter.

The tool is an all-purpose cutter with interchangeable cutter wheels for all types of pipe: cast iron, steel, as well as vitreous clay pipe. Requiring only space enough to move the tool in a small part of a circle, it is well suited for use in trenches or other tight places.—Ellis & Ford Mfg. Co.

Circle No. 1032 on Reader Service Card

Water Meters

Bulletin No. 60, a 20-page brochure, illustrates and describes this manufacturer's complete line of water meters in the following types: Frost-Bottom, recommended for areas where freezing weather is prevalent; Split-Case, suitable for temperate climate areas; Solid-Case, designed for warm climate areas; Commercial Style, for multiple dwellings, small industry and department stores; and Heavy Volume, recommended for use wherever large flows are encountered and full range accuracy is desired.—Buffalo Meter Co., Inc.

Circle No. 1033 on Reader Service Card

Volume, Density, and Porosity Measurements

An Application Data Sheet aimed at clearing up some of the ambiguity surrounding the term "density" has been published by this manufacturer.

For users of Beckman's Model 930 Air Comparison Pycnometer, the publication attempts to standardize terms by differentiating between substance density, particle density, apparent density, bulk density, surface porosity, total apparent porosity, and bulk porosity.

The Data Sheet also reports capabilities of the Pycnometer to produce accurate and rapid measurements of volume, density, and porosity. Measurement can be obtained with the instrument on powdery, granular, porous, and irregularly shaped solids. —Beckman Scientific and Process Instruments Division.

Circle No. 1034 on Reader Service Card

Liquid Chlorine Data Book

The seventh edition of the Pennsalt Liquid Chlorine data book has been simplified and tabbed by sections. Common physical properties, details on construction and unloading of various containers, materials of construction, and safety information have been described in concise, easy-to-use form.—Pennsalt Chemical Corp.

Circle No. 1035 on Reader Service Card

Laying Concrete Pressure Pipe

A 16-page, pocket-size manual issued by this manufacturer lists the step-by-step procedure for laying concrete pressure pipe.

Contained in the book are instructions for digging the trench, checking the grade, handling the pipe, lubricating the joint rings, making the joint, checking the gasket, completing the joint and bedding the pipe. Also included are photographs which illustrate how each step is completed, detail drawings, deflection data, current tables of pipe sizes, and a full list of supplies and equipment that are needed for the job.—Price Brothers Co.

Circle No. 1036 on Reader Service Card

Rotary Positive Blowers

A new 12-page bulletin issued by this manufacturer describes how Series 88 rotary positive displacement blowers provide constant metered quantities of gas or air, even against varying pressures.

The bulletin explains operating principles and tells how design permits mounting in several positions for maximum versatility. Other advantages such as low mechanical friction and insurance against gas contamination by lubricants are also discussed. Two pages of photographs illustrate samples of custom package units designed for special requirements.—Sutorbilt Corp.

Circle No. 1037 on Reader Service Card

Air Valve Catalog

Catalog R, a 26-page brochure, illustrates and describes this manufacturer's extensive line of air valves, identified under the trade mark of Crispin. These valves are designed and built to incorporate four important advantages: simplified construction; easy accessibility; maximum durability and efficient operation.

The following types are included in the catalog: Air and Vacuum Valves; Deep Well Air Valves; Pressure Air Valves; Model "P" Air Valves; Midget Air Valves; Combination Air Valves; Universal Air Valves; Dual Valves; Sewer Valves; Turbine Valves and Negative Pressure Air Valves.—Multiplex Mfg. Co.

Circle No. 1038 on Reader Service Card

Wall-Mounted Chlorinator

A four-page bulletin supplying specification data on this manufacturer's solution feed, vacuum type wall-mounted chlorinator (Series 3600) is available.

Features of the fiberglass housed unit, materials of construction, principles of operation, capacities, and rangeability are given along with a flow diagram and dimensional drawing.—Fischer & Porter Co.

Circle No. 1039 on Reader Service Card

Elevated Steel Storage Tanks

The design and function of elevated steel tanks for water storage are fully discussed in an attractive 20-page brochure. Particular emphasis is placed on spheroidal, radial cone and ellipsoidal tank designs in capacities ranging from 15,000 to 3,000,000 gal. Tables of standard capacities are included.—Chicago Bridge & Iron Co.

Circle No. 1040 on Reader Service Card

Submersible Pump Motors

8-page brochure illustrates and describes in detail this manufacturer's extensive line of submersible pump motors.

The brochure contains cutaway drawings showing special features of submersible motors for 6, 10 and 14 in. well diameters and explains the water-filled operating principle as opposed to the oil-filled principle of other submersibles. It explains also how windings are hermetically sealed in stainless steel to permit water-filled operation; how water circulation cools the motor and lubricates its bearings; ratings and specifications for submersibles from 5 to 300 hp; and other information of value.—U.S. Electrical Motors Inc.

Circle No. 1041 on Reader Service Card

Holloshaft Turbine Pump Motors

A brochure on its new line of Holloshaft Turbine Pump Motors for outdoor service has been announced by this manufacturer.

It explains the design features and principles of operation of the new motors and includes a large cut-away view, with call-outs to the principal features. Throughout the brochure, new design features—such as the fast oil-filling lubrication system—are fully described and illustrated. —U.S. Electrical Motors Inc.

Circle No. 1042 on Reader Service Card

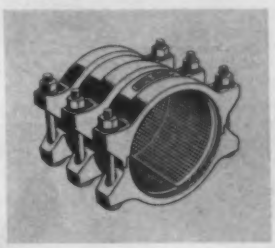
CONTINUED ON PAGE 114A

When a pipe breaks—

MINIMIZE SERVICE SHUTDOWN TIME

—installation as short as 6 minutes!

In the customer's mind, every service interruption is an emergency. You recognize this. Smith-Blair knows it, too, and has developed and field-tested products engineered for permanency and applied with minimum service interruption (Under some conditions, with no interruption at all!)



For example, Smith-Blair Fast-Action Clamp Couplings.

These heavy-duty, malleable iron couplings reconnect broken cast iron or asbestos-cement pipe in as little as 6 minutes installation time. With a high margin of safety, these couplings insure a full 7½ inch length of 360° closure on pipe. Featured are Smith-Blair's finely gridded gaskets and mold-tapered gasket ends and Smith-Blair's exclusive recessed armor. Such features assure uniform pressure seal over 360°. Smith-Blair Bulletin 1254, describing the Fast-Action Clamp Coupling together with price list, will be mailed to you, on request.

VALUABLE DATA YOU SHOULD HAVE

Smith-Blair manufactures a complete line for every pipe O.D. requirement. Check items that interest you, mail coupon today.

- ☐ Full Circle clamp couplings
- ☐ Taper-Seal service saddles
- ☐ Cast couplings
- ☐ Flanged coupling adapters
- ☐ Pipe repair clamps
- ☐ Compression couplings
- ☐ Steel couplings
- ☐ Tapping saddles; sleeves
- ☐ Fast-Action clamp couplings
- ☐ Expansion joints
- ☐ Meter couplings
- ☐ Pipe end caps

All of these from one, dependable source.

SMITH BLAIR

Smith-Blair, Inc.

535 Railroad Avenue, South San Francisco, Calif.
W. Newton Rd., Greensburg, Pa.
5635 E. Imperial Hwy., South Gate, Calif.
300 Waco St., Texarkana, Texas

—suppliers in all principal cities.

New Literature

CONTINUED FROM PAGE 113A

Merchandising Handbook for Builders and Contractors

"How to Promote and Merchandise Effective Sewage Disposal" is the title of a 24-page booklet recently announced by this manufacturer.

It has been published to help builders and contractors sell the hidden values of community facilities. The booklet discusses buyer attitudes and explains how to merchandise and promote equipment.—Yeomans Brothers Co.

Circle No. 1043 on Reader Service Card

Protective Coatings

13-page General Bulletin CAC-11-958 describes the complete line of Coal-Tar Protective Coatings offered by this manufacturer.

Primarily moisture barriers and impervious corrosion proofers, the coatings are particularly suitable for application on buried or immersed steel and concrete structures. Because of their inherent resistance to water penetration, chemicals and stress conditions, these coatings find wide use in a variety of industrial, utility and municipal installations.—Allied Chemical Corp.

Circle No. 1044 on Reader Service Card

Clay Pipe Catalog

40-page catalog presents the complete line of clay pipe and allied clay products available from this manufacturer.

The fully illustrated catalog lists sizes and dimensions of standard strength, extra strength, perforated, and double-length vitrified clay pipe; Wedge-Lock clay pipe with plastisol double-ball joint; Wedge-Lock Type "O" clay pipe; standard, special and Wedge-Lock fittings; and allied clay products.—Evans Pipe Co.

Circle No. 1045 on Reader Service Card

Tapping Manual

12-page manual recently issued by this manufacturer describes the step-by-step procedure for tapping prestressed concrete steel cylinder pipe under pressure.

The handy booklet discusses the basic construction of the pipe, and describes how small and large taps can be made quickly and safely with ordinary tapping tools and with no interruption in service.—Price Brothers Co.

Circle No. 1046 on Reader Service Card

Single Stage Split Case Pump

4-page Bulletin 1600 illustrates and describes the manufacturer's Type U-VBM Vertical Non-Clog, Ball Bearing Centrifugal Pumps for handling sewage and liquids containing solids.—The Weinman Pump Mfg. Co.

Circle No. 1047 on Reader Service Card

Rubber Joints for Concrete Pipe

Engineers, contractors, and public officials concerned with designing, constructing and financing sewerage and drainage systems will find useful information in a new

G-A CUSHIONED FLOWTROL VALVE

It's easier to operate a G-A Flowtrol Valve than it is to drive a car with power steering! The reason? Line pressure furnishes the power to open or close the valves. No manual effort, no handwheels, no motors, no levers are needed—regardless of size of valve or pressure. Just a "flick of the wrist" or press of a button will fully open or tightly close the valve.

Get all the facts in Bulletins W-8A and G-4.

GOLDEN ANDERSON Valve Specialty Company

1254 RIDGE AVENUE, PITTSBURGH 33, PA.

Designers and Manufacturers of VALVES FOR AUTOMATION

16-page manual on Tylox Flexible Pipe Joints recently published by the manufacturer.

Five different gasket designs are described and diagrammed, covering Tylox jointing for concrete Tongue and Groove, Bell and Spigot, Offset and Recessed pipe, and modifications of these.—Hamilton Kent Mfg. Co.

Circle No. 1048 on Reader Service Card

Controlled Closing Air Valve

Bulletin 1225 describes construction features and principle of operation of the manufacturer's Type CCAV controlled closing air valve, specifically designed to protect transmission lines against the dangerous effects of water hammer.—Simplex Valve and Meter Co.

Circle No. 1049 on Reader Service Card

Sewage Treatment Plant

4-page Bulletin 102 on the Cavitator® sewage treatment plant, factory built and delivered ready to place in the excavation. Designed especially for schools, hospitals, factories, trailer courts, subdivisions, institutions, etc. Contains notes on design, specifications and other technical data.—Yeomans Brothers Co.

Circle No. 1050 on Reader Service Card

Sewage and Sludge Pumps

4-page Bulletin 6250-R describes sewage and sludge pumps, in capacities of 50 to 24,000 G.P.M. and for heights up to 130 ft. It contains complete technical data and installation details.—Yeomans Brothers Co.

Circle No. 1051 on Reader Service Card

Crane-Excavators

12-page specification bulletin covers this manufacturer's Series "500" crane-excavators.

It includes complete capacity charts, work ranges, features, and other specifications on the 11-ton carrier-mounted Model T-350, the 11-ton self-propelled Model CR-350, and the 8-ton Model C-350 crawler-mounted unit, as well as the complete line of front end attachments. —Schield Bantam Co.

Circle No. 1052 on Reader Service Card

Bronze Valves

Eight-page Catalog 60 covers the complete line of bronze valves available from this manufacturer.

The items include screw end or sweat end gate valves with "O" ring or conventional packing, renewable disc or standard brass seat screw end globe valves, screw end or copper-to-copper compression stops and valves, and a wide variety of gas cocks, check valves, radiator valves, circulator valves and balancing elbows.

Accompanying dimension charts, diagrams and roughing-in data provide full details for layout planning and fixture specifying and ordering.—American Valve Mfg. Co.

Circle No. 1053 on Reader Service Card

Clay Sewer Pipe

This 4-page brochure illustrates and describes the Tex-Vit DELTA-SEAL clay sewer pipe, featuring a perfectly fitted, factory-made joint of semi-rigid polyester, molded around the spigot end and inside the bell, with a rubber compression ring attached to the spigot. A sec-

CONTINUED ON PAGE 116A

NON-CLOG
DRY PIT PUMP
With motor, motor support bracket, pedestal and combination stand and elbow with cleanout plate. Ask for Bulletin 1850.5.
UNITYPE DRY PIT MODEL
Motor shaft connects directly to impeller and mounts on volute. Ask for Bulletin 1850.5.
NON-CLOG WET PIT TYPE
With cover. Single unit. Duplex units with alternating controls available. Send for Bulletin 1850.2.
Ad No. 149A
HORIZONTAL NON-CLOG MODEL
With flexible coupling. Fully described in Bulletin 1850.5.
A TYPE FOR
PACIFIC
Non-Clog
EVERY SERVICE
SEWAGE PUMPS
RUGGED AND DEPENDABLE
DRY PIT
WET PIT
SUBMERSIBLE
HORIZONTAL
CHOICE OF IMPELLERS
Outstanding performance and long trouble-free service from every type.
Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.
ORDER NOW: ALL TYPES AVAILABLE FOR IMMEDIATE SHIPMENT.
PACIFIC PUMPING COMPANY
ESTABLISHED 1907
Manufacturers and Distributors of Pumps for Every Service
Main Office & Factory: 9201 San Leandro St., Oakland 3, Calif.
Mailing Address: P.O. Box 44, Oakland 4, California
OAKLAND · PORTLAND · SEATTLE · LOS ANGELES · DALLAS
SUBMERSIBLE NON-CLOG
A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.7.
WATER SEAL UNITS
For maintaining clean-water pressure supply to packing glands of pumps or to water-cooling jackets of hot liquid pumps. Ask for Bulletin 1870.

New Literature

CONTINUED FROM PAGE 115A

tion deals with method of installation.—Texas Vitrified Pipe Co.

Circle No. 1054 on Reader Service Card

Installation Handbook for Transite Pipe

A revised edition of this manufacturer's "Installation Guide for Transite Pressure Pipe" has been published.

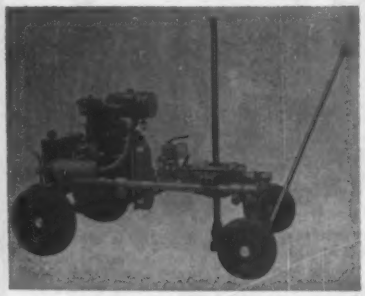
The Guide shows the latest product design information and field installation recommendations. It covers the handling and unloading through assembly of pipe and couplings, cutting and machining, design of thrust blocks, service connections, backfilling and tamping, testing and many other on-the-job practices. It includes considerable tabular data plus numerous illustrations.—Johns-Manville Corp.

Circle No. 1055 on Reader Service Card

Payne Dean & Company, Clinton, Conn.

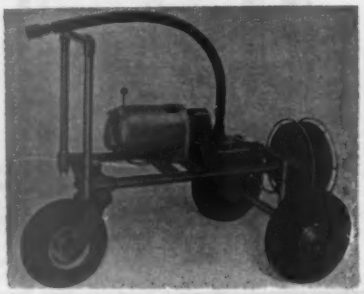
Truck-mounted, hydraulic valve operators provide fast, safe control of 10" to 60" valves

One Man Control of Speed and Torque on Gate Stem with Indication. Two Safety Control Devices.



4-Speed Electric Motor Gatenders. For Floor-Stand and Under Floor Operation. 1 to 5 HP 10" To 36" Valves.

Portable Engine Driven Gatenders, For Valves 10" to 36". All Hydraulic Operation. Two Safety Features.



Transite Pressure Pipe

8-page Bulletin TR-160A describes the advantages of Transite pressure pipe for use in water mains.

Bulletin contains tabular data giving the sizes and weights of Transite asbestos-cement pressure pipe in the three available classes, 100, 150, and 200. Methods of manufacture, quality control, installation, and assembly are fully explained.

Considerable emphasis is given the Ring-Tite method of assembly, illustrated through cut-away drawings.—Johns-Manville.

Circle No. 1056 on Reader Service Card

Proportional Treatment Systems

Single sheet bulletin combines information on two different techniques of automatically proportioning chemical solution feeds. One system uses a standard displacement meter with a contactor and timer. The other system uses an air operator which automatically positions the output control of the pump in response to an air signal from a controller or combination recorder-controller. The latter system provides more precise control and permits continuous operation of the pump. The former system is simpler and less expensive, and is well suited to many water treatment applications.—Precision Chemical Pump Corp.

Circle No. 1057 on Reader Service Card

Utility Trencher

Four-page Bulletin No. L-111 illustrates and describes in detail the advantages and features of the Cleveland Trencher Model TS-30. Applications for this versatile machine include: pipelines, phone conduit, footings, bellholes, highway widening, sewers, septic tanks, leach beds, and small excavations.

Hydraulic power-tilting of the digging wheel to either side of vertical

permits digging vertical trench on side slopes, and in similar conditions, with one crawler track on a higher lever than the other. Power-tilt adds 7 in. to the outside cut of the digging wheel. This in combination with lateral power-shift permits digging trench virtually flush with The Cleveland Trencher Co.

Circle No. 1058 on Reader Service Card

Sanitation Chemical

Technical data sheet describes nature and uses of "Cifon", an emulsifiable, noncorrosive, non-flammable sanitation chemical. It is compatible with soap and contains no caustic, free chlorine or carbolic acid.

In sewage treatment plants, "Cifon" is used for deodorizing at bar screens, sludge storage tanks, and primary sedimentation such as digested sludge spread out to dry. It is also sprayed on garbage dumps to prevent the breeding of insects and counteract the odor of the garbage.—Fine Organics, Inc.

Circle No. 1059 on Reader Service Card

Ball Valve

Six-page catalog BA-1 describes design features, principle of operation and construction details of a new rubber seat ball valve designed for pressures up to 250 lbs. and high velocities. A rubber seat provides bubble-type closure at all operating pressures. Furnished in sizes 10 in. through 54 in., these valves are equipped with flanges for 150 psi or 250 psi service. A complete choice of manual, pneumatic, hydraulic or electric operators are offered.—Henry Pratt Co.

Circle No. 1060 on Reader Service Card

Control Panel

New brochures published by this manufacturer describe various types of controls for integrating any vented tank system, pressure tank system or tankless system for water, waste or industrial processing and telemetering.—Autocon Industries, Inc.

Circle No. 1061 on Reader Service Card

Pipe Detection

A 24-page pocket-sized book "Typical Pipe Detection Problems and Their Solution" has been recently published by Computer Measurement Co.

With this "how to do it" guide, repair and installation crews can locate, trace, center or determine the depth of pipes, conduits, and cables with their pipe detectors by following the steps outlined in the book. A section in the book explains in easily understandable language the basic theory of the pipe detector. —Computer Measurements Co.

Circle No. 1062 on Reader Service Card

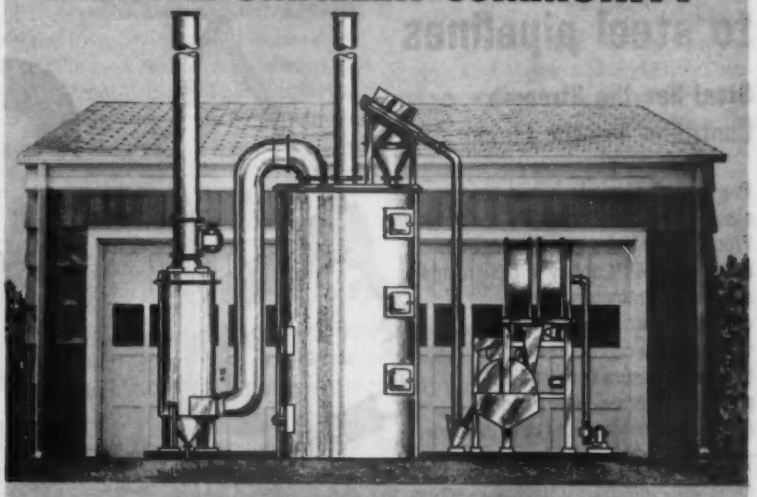
Powdered Acid Cleaner

Bulletin HSP-940, a 4-page brochure, illustrates and describes methods of using Powdered Acid Cleaner in removing scale deposits from boilers, heat exchangers, water lines, pumps, and other equipment. It is easy to handle, and there is no danger of fire, toxic fumes or explosion.—Hagan Chemicals & Controls, Inc.

Circle No. 1063 on Reader Service Card

CONTINUED ON PAGE 118A

NICHOLS *Compact*
SLUDGE DISPOSAL PLANT
FOR THE SMALLER COMMUNITY



IN LESS SPACE THAN A TWO-CAR GARAGE!

COMPLETE DESTRUCTION—The Nichols system destroys all putrescible solids.

CLEAN—All gases scrubbed before discharge to atmosphere complying with most stringent air pollution requirements.

Furnace ash is sterile, inert, completely odor free; packs firmly, provides excellent fill material.

ECONOMICAL—Low first cost. Operating savings: No chemicals, no fuel to sustain combustion, negligible power consumption, low maintenance and little personal attention.

SAFE—Since no chemicals are required, corrosive materials affecting equipment and personnel are eliminated.

For further information write for our new Bulletin 245.

PUBLIC WORKS DIVISION
NICHOLS ENGINEERING & RESEARCH CORP.
80 Pine Street, New York 5, New York
3513 N. Hovey Street, Indianapolis 18, Ind. • 1336 North Carolan Ave., Burlingame, Calif.

New Literature

CONTINUED FROM PAGE 117A

Soil Solidification and Stabilization

Bulletin T-48-4, a 2-page technical sheet, discusses the use of sodium silicate and calcium chloride in soil solidification, as an effective method of increasing the load-bearing strength of the ground. This method is being successfully applied in building sewers or in any construction work where loose running sand or underground water flows present a problem.—Philadelphia Quartz Co.

Circle No. 1064 on Reader Service Card

Control of Micro-organisms

44-page booklet issued by this manufacturer thoroughly discusses the use of copper sulphate in the control of microscopic organisms. This is the seventh edition of this treatise which has proven very useful to water works and sanitary engineers, health officers, technical instructors and others throughout the world.

In addition to many illustrations, the booklet includes tables, photographs and diagrams.—Phelps Dodge Refining Corp.

Circle No. 1065 on Reader Service Card

CENTRILINE
adds
PERMANENCE
to steel pipelines

Steel has the Strength
Centriline has the Lining

Even before they are put in service, steel pipelines can be improved by the Centriline Process. To steel's great strength, durability and flexibility of design, add a smooth, continuous Centrilining of cement-mortar. Corrosion and tuberculation cannot then attack the line. Pressure is maintained, pumping costs stay down, and operating problems are cut to the bone.

Trained Centriline crews and all necessary equipment are spotted strategically across the U.S., Canada and Latin America—ready to work on new pipe or to renovate pipelines already in place. Only a very few excavations are needed in this latter process. Our engineers will also help in the design and specification of Centrilined steel pipes.

Because of these advantages and services, many major cities now specify in-place cement-mortar lining—evidence that Centrilining steel pipe (up to 12 feet in diameter) is a good move in the direction of real economies. Send today for our illustrated brochure that covers the entire Centriline process. On special problems, our engineers will be pleased to consult with you at once.

CENTRILINE CORPORATION
A Subsidiary of Raymond International Inc.
140 CEDAR STREET • NEW YORK 6, N. Y. • WOrth 2-1429
Branch Offices in Principal Cities of the United States, Canada and Latin America

Water Meters

28-page bulletin presents manufacturer's extensive line of Trident water meters. It discusses metering and its many advantages in solving the problem of wastage which often leads to municipal water shortages.

Buletin also describes design features of Trident Frost—Proof disc meters, split-case disc meters, style 3 disc meters, crest meters, compound meters and fire service meters. The final section deals with testing of water meters.—Neptune Meter Co.

Circle No. 1066 on Reader Service Card

Filter Sample Folder

A filter sample folder available from this manufacturer gives complete information on the Millipore filter.

This filter is a thin plastic screen with millions of tiny pores (50 million capillary pores per sq. cm.) evenly distributed over its surface area. These pores pass directly from the top surface to the bottom. The filter is biologically inert and has heat and chemical resistance characteristics typical of esters of cellulose. Pore size is precisely controlled. In the HA grade, the variation of screen opening is ±4% at a nominal pore size of 0.45 micron.—Millipore Filter Corp.

Circle No. 1067 on Reader Service Card

Sludge Removal Bulletin

New 12-page bulletin describes the Rex Unitube Tow-Bro, sludge remover for industrial and municipal use.

The bulletin outlines why the Unitube design allows a saving of 20 percent or more in equipment costs as compared to the previous nozzle and arm design, and explains why the Tow-Bro principle provides a

more rapid sludge removal.

In addition, the bulletin features a 4-page photographic section which illustrates the adaptability of the Tow-Bro to any size or type of tank for uniform and positive performance.—Chain Belt Co.

Circle No. 1068 on Reader Service Card

Magnetic Drive Variable Speed Control

Two catalog sheets give complete details on operation of E-M "Ampli-Speed" magnetic drives, vertical and horizontal, that offer variable speed and automatic speed control for maximum pumping flexibility. Specifications, drawings and selection charts are included.—Electric Machinery Mfg. Co.

Circle No. 1069 on Reader Service Card

Water Works Brass Goods

4-page brochure illustrates and describes this manufacturer's extensive line of water works brass goods, including among others copper service pipe couplings, curb stops, corporation stops, meter stops and couplings, and extension curb boxes.

The brochure gives sizes, design features and concise information on each separate item.—A. Y. McDonald Mfg. Co.

Circle No. 1070 on Reader Service Card

Motorized Sludge Valve

Recent brochure issued by the manufacturer announces a new fully-motorized telescoping sludge valve identified as the Mo-Tel-Valve.

Factory-assembled, tested and set for the required travel before shipment, the new valves are offered in 5 sizes, from 4 in. to 12 in., utilizing a motorized valve control suitable for single or three phase operation. Standard units provide 4 ft. travel.—The American Well Works.

Circle No. 1071 on Reader Service Card

Circular Collectors

20-page Bulletin No. 9-W-65 illustrates and describes this manufacturer's line of Circular Collectors especially designed for municipal or industrial water and sewage treatment, and certain industrial processes.

Bulletin explains the reasons for the selection of circular or square setting tanks rather than rectangular tanks, and describes in detail various types of units available: center pier-supported, bridge supported, and tractor drive collectors.— Walker Process Equipment, Inc.

Circle No. 1072 on Reader Service Card

Filter

Bulletin 651, a 10-page color brochure, gives complete information on manufacturer's extensive line of filtration equipment. It includes discussion of design and application of filters for potable water, process liquids and gases and industrial waters. A section presents some typical arrangement of units, with drawings and tables of dimensions.—R. P. Adams Company, Inc.

Circle No. 1073 on Reader Service Card

CONTINUED ON PAGE 120A

NOW
LOW-COST AUTOMATIC FLOW RECORDING

Directly Readable Flow Charts

Obtain graphic records of liquid flow directly readable in million gallons per day or gallons per minute over various sizes of Parshall flumes. The same recorder can also be used with charts reading in feet and hundredths to record head or surface fluctuations in lakes, streams, wells. Write for free Bulletin 24.

STEVENS
TYPE F RECORDER

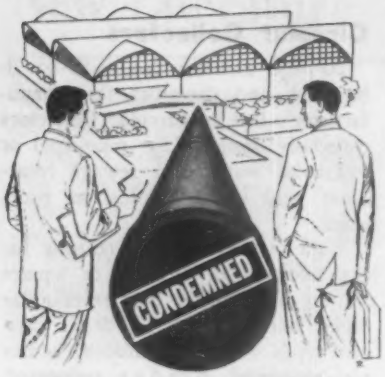
...For Measuring Sewage, Industrial Waste and Other Flows

The planning and efficient operation of any project which involves measurements of flowing liquids is based on flow data which can be obtained with STEVENS Recorders. These instruments are at work compiling data on hydroelectric and flood control projects and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

Experienced technical staff available to supply product information for liquid measurement installations. Write, giving description of project and scope of data desired.

HYDROGRAPHIC DATA BOOK
Invaluable for your reference file
124 pages of technical data on recorder installations, plus a wealth of hydraulic tables and conversion tables. $1 copy. (No COD's.)

LEUPOLD & STEVENS INSTRUMENTS, INC.
4445 N. E. GLISAN STREET • PORTLAND 13, OREGON
specialists in hydrologic instruments for over half a century



LET US SOLVE YOUR INDUSTRIAL WASTE PROBLEM

Today's modern industries and processes often create industrial waste problems that can actually stall profit-making applications of new discoveries.

Naturally enough, communities feel that public health comes first, and some industrial wastes and acids may eat up sewer lines fast.

At Crystal Lake, Illinois, the Clay Pipe industry has built a modern new research and testing laboratory. Experimentation is constantly going on to test pipe and jointing materials to see which is actually the best under all conditions for sanitary and industrial wastes.

Tests show that Vitrified Clay Pipe with its new resilient self-sealing joints is impervious to the corrosive action of sanitary sewerage and industrial wastes and acids which normally flow through sewer lines.

But yours may be a special problem. Let us help you with it. Write, outlining the problem to be tested, to:

National Clay Pipe Manufacturers, Inc.
1028 Connecticut Ave., Washington, D. C.

COMPRESSION SEALED, VITRIFIED
CLAY IMPERVIOUS PIPE
THE STANDARD in SANITARY SEWERS

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1028 Connecticut Ave., Washington, D. C.
Please send me full details on the new factory-made compression joints on Clay Pipe.

(name)
(company)
(street address)
(city and state) B-813 WS

New Literature

CONTINUED FROM PAGE 119A

Curb Stop

Folder No. 400, released by this manufacturer, gives complete information on the Nuseal® Curb Stop.

A few of the exclusive features are the following: easy turning, since there is no contact between metal parts. This also prevents binding or freezing of plug; bubble tight shut off and leakproof service at 0 to 125 psi; flow may be in either direction; lifetime self lubricating quality of Teflon Nuseal eliminates lubrication and maintenance; solid Tee head indicates open and closed position.—Hayes Mfg. Co.

Circle No. 1074 on Reader Service Card

Odor Control Problems Solved

4-page brochure issued by this manufacturer illustrates and describes how typical waste odor problems may be successfully controlled, whether over a large or a small area.

Although each sewage problem must be treated individually, the company's odor counteractant chemicals quickly and thoroughly kill odors emanating from pumping stations, grit screen areas, digesters, trickling filters, sludge beds and lagoons. The chemical installations have no effect on natural bacterial processes and are effective on soluble and insoluble gases.

The complete systems are easy to install, require no interruption of plant operation and need little attention once the correct dispersion rate is selected.—Airkem.

Circle No. 1075 on Reader Service Card

Small Waste Treatment Plants

Bulletin No. 417, an 8-page brochure, illustrates and describes this manufacturer's Oxy-Pak® total oxidation waste treatment plants, suitable for the needs of populations from 10 to 3000 people.

For populations through 150, units are complete including steel tank, requiring a minimum of erection construction. Concrete tank structures are recommended for populations

WILEY BOOKS

UNIT OPERATIONS OF SANITARY ENGINEERING

By L. G. RICH, *Professor and Head, Department of Civil Engineering, Clemson College*

Contrasting with the traditional books using the process approach, this book treats sanitary engineering from the unit operations point of view, thus offering several advantages. First, the fundamental principles are set forth quite clearly, divorced from the often confusing ramifications of particular applications. Then, chemical engineering notation can be used throughout the book, enabling the reader to use related literature in the process engineering field, and to apply it to his particular problems.

Covers special operations

Certain unit operations not ordinarily discussed are given space in this book, especially those of importance in the treatment of industrial wastes. Such operations include aerosol separation, gas transfer in packed tower and tray columns, heat transfer, evaporation, and drying.

Details of equipment design are covered only briefly, but examples of unit operations, with solutions, are used to illustrate each major point in the design of the operations themselves.

Includes:

Fluid transport in closed conduits • Fluid transport in open conduits • Mixing • Sedimentation • Flotation and aerosol separation • Flow through beds of solids • Vacuum filtration • Gas transfer • Adsorption and leaching • Heat transfer • Evaporation • Psychrometry and humidification • Drying

1961 308 pages $10.75

Send now for your on-approval copy

JOHN WILEY & SONS, Inc.
440 Park Avenue South
New York 16, N. Y.

over 150. For populations of 1000 and up it is recommended that double concrete aeration tanks be used. —American Well Works.

Circle No. 1076 on Reader Service Card

Psychoda Fly Control

The control of psychoda flies in trickling filters is described in a 4-page bulletin and two reprints from two magazines in the sewage and wastes treatment field. The articles describe how RSC insecticide was used to control this problem in two particular treatment plants where other chemicals failed.

On-the-job photographs are provided in the literature and tables are presented which compare this insecticide with the performance of others. This chemical has proven to be effective in controlling DDT resistant insects.—Glenn Chemical Co., Inc.

Circle No. 1077 on Reader Service Card

Remote Controls for Valves

A new Design Manual on the remote control of valves has been published by this manufacturer.

The Manual, which gives complete dimensional data and selection information, is divided into three sections. Section 1 covers flexible shafting including remote operating terminals, valve couplings and intermediate connections; Section 2 covers exclusive rigid reach controls; and Section 3 covers the Stow 300 degree geared joint.—Stow Mfg. Co.

Circle No. 1078 on Reader Service Card

Vertical Sewage Ejectors

8-page Bulletin 800 explains in detail the features of vertical non-clog sewage ejectors designed for positive handling of raw, unscreened sewage in commercial buildings and industrial plants.—The Weinman Pump Mfg. Co.

Circle No. 1079 on Reader Service Card

Water Purification

"Taste and Odor Control in Water Purification," a 76-page book issued by this manufacturer, offers a complete review of the problem of maintaining palatability in water supplies.

Including a historical review, it covers: natural sources and industrial wastes sources of taste and odor; determination of odor concentration; control by water plant processes; mechanism of control by activated carbon; application in treatment plants, open settling basins and reservoirs; determination of dosages required; storage, handling and feeding of activated carbon. Manufacturing methods and a description of Aqua Nuchar® Activated Carbon are also contained in this authoritative guide. Available free to water works officials.—Industrial Chemical Sales Div., West Virginia Pulp & Paper Co.

Circle No. 1080 on Reader Service Card

Setting and Testing Equipment for Water Meters

New Ford Catalog No. 62 offers a complete listing of this manufacturer's line of equipment for setting and testing water meters.

It includes items not shown in previous catalogs, such as Plumbhorns and Pretzelhorns for basement

CONTINUED ON PAGE 122A

Roll-call for water

the Bird Woman's home

When Lewis and Clark first explored western United States, they found an exceptional Indian woman in what is now Missouri. Her name was Sacajawea (said to mean bird woman) and her services as guide and interpreter to the expedition were invaluable. It was a wild and rough journey. There were no cities and no public water distribution system in the Prairie Belt states in those days. But the report of their expedition inspired thousands of eastern people to organize wagon trains and start West from St. Louis, as Lewis and Clark had done, up the Missouri River and her tributaries.

Today this Prairie Belt of 7 west-north-central States produces grain and is sometimes called America's bread basket. The Indians and the buffalo are gone. In their place are modern farms, homes, highways, railways, airports and cities. Of the 40 cities of 25,000 population or more, 29 have adequate water systems, 5 have water works of uncertain efficiency, and 6 have water works which are definitely deficient in overload capacity.

Minnesota
Iowa
Missouri
North Dakota
South Dakota
Nebraska
Kansas

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

★ "MARKETS UNLIMITED" ★

THREE PHASE SEWAGE PUMPING STATION..... OPERATES ON SINGLE PHASE with the Add-A-Phase

SMITH & LOVELESS
Division — Union Tank Car Company
LENEXA, KANSAS

Artist's installation drawing of a Smith & Loveless factory-built duplex sewage pumping station. The Smith & Loveless pump station is designed for capacities from 100 GPM to 4,500 GPM per pump with two or more pumps per station.

Add-A-Phase POWER CONVERTER

- Balances for Any Load
- 100% Rated Load
- High Power Factor
- Balanced Currents
- No Loss of Work Power

Write for Complete Information

Dept. WSW-10
ADD-A-PHASE
Div. System Analyzer Corp., Nokomis, Illinois
Gentlemen: Please send, without obligation, complete details on your ADD-A-PHASE Power Converter.
Name_____Title_____
Company_____
Address_____
City_____Zone_____
State_____

SEE FOR YOURSELF . . . package includes many case histories of the success of the Add-A-Phase . . . years of trouble free use. IF YOU HAVE A SPECIFIC ELECTRIC POWER PROBLEM GIVE US THE DETAILS FOR RECOMMENDATION.

New Literature

CONTINUED FROM PAGE 121A

and utility room settings, Inter Americana Meter Boxes, Compression Ringstyle Valves, Lead-Pak Couplings, Pack Joint Pipe Couplings and Meter Shop Equipment.

An informative section on fundamentals discusses the economic and engineering factors pertinent to the setting of water meters and the choice between inside and outside settings. —The Ford Meter Box Co., Inc.

Circle No. 1081 on Reader Service Card

New Installation Handbook For Sluice Gates

The publication of a new handbook on Installation, Operation and Maintenance of Sluice Gates has been announced by this manufacturer. Although designed primarily to accompany shipments of the manufacturer's sluice gates, advance copies are available to construction companies, job superintendents, operating engineers and others concerned with facilities employing sluice gates.

The pocket-size, illustrated booklet contains instructions on the handling and storage of sluice gates, recommended installation and adjustment procedures, and suggestions on proper operation and maintenance.—Rodney Hunt Machine Co.

Circle No. 1082 on Reader Service Card

Bulletin Describes Controllers, Transmitters and Receivers

Specifications of the American Series 88 pneumatic Controllers, Transmitters and Receivers are described in Bulletin 406, just published by the manufacturer.

Designed to control and transmit flow, pressure, liquid level and other continuous process variables, these instruments incorporate many newly developed features to simplify adjustments, decrease maintenance and provide increased adaptability. Bulletin includes cutaway illustrations showing internal design features. Complete descriptions, weights, dimensions and capacities are given. —American Meter Co.

Circle No. 1083 on Reader Service Card

SUTORBILT BLOWERS FOR EFFICIENT SEWAGE TREATMENT

• Sutorbilt 3200 Series Blowers for large air capacity needs.

High performance and low maintenance are assured with these precision machined, positive-pressure blowers and gas pumps. They deliver 800 to 23,000 cfm of clean, dry air at pressures from 2 to 12 psig. Available with timing gear diameters from 10" through 26" in horizontal designs. Many sizes also offered with vertical case arrangements. Ideal for aeration of grit chambers, channel aeration, pre-aeration flotation, flocculation, tank aeration, air lifts, gas recirculation. For specifications, Send for Bulletin S-32-A.

• Features of Sutorbilt Blowers:
TWO-PIECE CASE, strongly ribbed to prevent distortion
ONE-PIECE 4140 FORGED STEEL SHAFT, slip-fitted through impellers, attached at gear ends, allowing increased pressure and horsepower ratings with complete safety
OVERSIZE ROLLER BEARINGS, in cartridges for easy removal
HELICAL ALLOY TIMING GEARS, piloted to shaft and bolted to timing hub
CLOSE-GRAIN IRON IMPELLERS, precision bored to receive shaft
MACHINED SUB-BASES as standard equipment
LUBRICATION by force-feed pressure system

• Sutorbilt blowers for smaller capacity requirements — California B Series Blowers . . . for higher speeds, greater outputs.

Thrust bearing on drive shaft permits V-belt or direct drive. Steel timing gears for extra long service. Dynamically balanced impellers for high-speed operation. Write for Bulletin S-59-I, Dept. H.

Sales representatives in principal cities

4471
S-36

SUTORBILT IS WELL BUILT
CORPORATION

2966 EAST VICTORIA ST. • COMPTON, CALIF.
Subsidiary of Fuller Company • Catasauqua, Pa.

How to Select The Right Pneumatic Conveyor System

How to determine the correct pneumatic conveying system for any pulverized or granular material is discussed in a four-page report now available. Entitled "Match Material to System for Successful Pneumatic Conveying," the report is a reprint of an article written by H. A. Stoess, Jr., Assistant Manager of Fuller's General Conveying Division.

The report contains a listing of material characteristics—such as weight, fineness, moisture content, flow characteristics—that the prospective user of pneumatic conveying must consider before he can select the right system for his particular material. Different pneumatic conveying methods are discussed in this connection.—Fuller Co.

Circle No. 1084 on Reader Service Card

New Condensed Catalog Released by Syntron

A new condensed catalog of vibratory materials handling equipment, vibrating parts handling equipment, mechanical shaft seals, paper joggers, portable power tools and power rectification equipment has been published by this manufacturer.

The new catalog, No. 616, contains over 200 illustrations and presents descriptions, data and specifications on all Synthron products—Syntron Co.

Circle No. 1085 on Reader Service Card

How to Build a Form

"How to Build a Form" is the subject of a new booklet offered by this manufacturer. The useful 12-page booklet combines a cartoon approach with actual in-plant photos in telling what it takes to make a form.—Symons Clamp & Mfg. Co.

Circle No. 1086 on Reader Service Card

Pneumatic Temperature Transmitter

Described in Bulletin 13-17C is the type 12A Pneumatic Temperature Transmitter developed by this manufacturer. Features of transmitter design are emphasized: compact construction; force-balance operation; and automatic compensation

CONTINUED ON PAGE 124A

MALLEABLE IRON or

DROP FORGED?

Rugged dependability suggests that you insist on the best — Simplex *drop forged steel* trench braces.

Ball and socket joints at each end for tight grip at any angle. Blunt lever nuts or 3-way nuts — nail holes in both screw and butt ends. Furnished with or without pipe.

Simplex drop forged steel trench and timber braces *cost no more* and better eliminate the danger of cave-ins and costly re-digging.

SEND FOR MECHANICAL JACK CATALOG

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL MECHANICAL AND HYDRAULIC JACKS

SIMPLEX JACKS

RS-MO-TROL UTIL-A-TOOL JENNY ROL-TOR

TEMPLETON, KENLY & COMPANY
2569 Gardner Road
Broadview, Illinois

ACTIVATED SILICA SOL

. . . coagulant aid

The "method" of convenience . . .

- **Liquid feed**
- **Quickly speeds floc formation**
- **No delays**

Activated silica sol develops large, rapid settling floc. More impurities are removed. High quality, clear water is produced during exceptionally long filter runs.

N-Sol Processes, employing "N" sodium silicate, are PQ's patented methods for preparing activated silica sol. Licenses are available without royalty fee.

Write for this complete bulletin on the use of sodium silicate for "Raw and Waste Water Treatment".

PHILADELPHIA QUARTZ CO.
1166 Public Ledger Bldg., Philadelphia 6, Pa.

PQ SOLUBLE SILICATES

Trademarks Reg. U.S. Pat. Off.

Associates: Philadelphia Quartz Co. of Calif. Berkeley & Los Angeles, Calif.; Tacoma, Wash.; National Silicates Limited, Toronto & Valleyfield, Canada

PQ Plants: Anderson, Ind.; Baltimore, Md.; Buffalo, N.Y.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kan.; Rahway, N.J.; St. Louis, Mo.; Utica, Ill.

Re-new your structures with GUNITE!

★ durability
★ economy
★ flexibility

- DAMS
- RESERVOIRS
- TUNNELS
- GRAIN ELEVATORS
- BREAKWATERS
- CONCRETE TANKS
- FILTER PLANTS
- STADIUMS
- SEA WALLS
- PIPE LINES
- SEWERS
- STACKS
- BRIDGES

estimates, specifications and surveys made free of cost to you. write, wire or call MElrose 4-8120

INDIANA GUNITE & CONSTRUCTION CO., Inc.

ENGINEERING—CONSTRUCTION

CONTRACTS TAKEN ANYWHERE

Box 600 • Florence, Ala.

INDIANA GUNITE & CONSTRUCTION CO., INC.
1734 Villa Ave. • Indianapolis, Ind.
Gentlemen: Please have a representative contact me. I am interested in:
Description.....
.....
.....
NAME.....
STREET.....
CITY.....STATE.....

New Literature

CONTINUED FROM PAGE 123A

for ambient temperature and pressure changes.

The 12-page bulletin illustrates how easily the transmitter can be installed and adjusted to suit a wide range of application requirements. Also included are detailed specifications, descriptions of operating principle, table of temperature ranges, and data on related accessories.—The Foxboro Co.

Circle No. 1087 on Reader Service Card

Water Treatment System

This manufacturer has issued an illustrated brochure explaining the operating principles of its Helifloc Packaged Water Treatment System. The equipment provides disinfection, clarification and filtration.

The Helifloc consists of an upflow suspended solids contact clarifier, chemical feed equipment, external sludge concentrator, clear well and filter. The brochure describes each part of this equipment and analyzes the several phases through which the raw water passes in the process. The System follows the classic treatment of aeration, coagulation-flocculation, clarification, disinfection and filtration.—Met-Pro Inc.

Circle No. 1088 on Reader Service Card

3-Wheel Utility Vehicles

An 8-page brochure that illustrates and describes the 1962 line of Cushman Trucksters is available. In addition to the gasoline-powered Trucksters, the brochure also covers Cushman's complete line of electric-powered Trucksters.

Complete mechanical specifications for each Truckster are given and cut-away views are included to show construction and operational details. Twelve typical applications are also shown.—Cushman Motors, Subsidiary of Outboard Marine Corp.

Circle No. 1089 on Reader Service Card

Basics of Flow Ratio Control Presented in Bulletin Form

Four-page Bulletin 91-10-01, available from this manufacturer of process control instrumentation, presents

ENSLOW

STABILITY INDICATOR

For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

Our Service Is A STIMULATING OPERATION Making Old Water Towers & Standpipes Look Like New Jobs

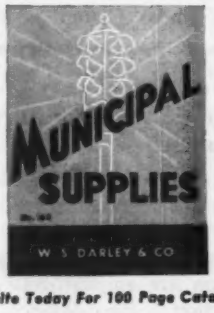
SURFACE MATERIALS THAT ARREST CORROSION

All guaranteed work

SPEELMON ELEVATED TANK SERVICE

Complete Painting & Repair Service

822 N. Court St. Rockford, Ill.



Write Today For 100 Page Catalog

W. S. DARLEY & CO. Chicago 12

DON'T DIG THROUGH BURIED PIPELINES!

Find them fast with

DETECTRON "505"

This portable precision instrument makes short work of determining exact location and depth of buried pipes, cables, manhole covers. Not a radical experimental design, but proven by years of use in municipalities and industry. Full effectiveness in all temperature ranges.

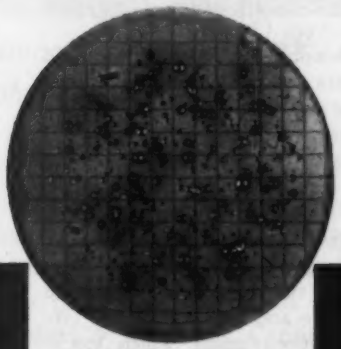
Housed in rugged aluminum case, Detectron "505" features shielded loops and locked-in tuning for pinpoint accuracy; unit construction for simple maintenance. WRITE TODAY FOR DATA AND LOW PRICES.

DETECTRON

DIVISION OF TINKER AND RASOR

P. O. Box 243 • Dept. WS-10

SAN GABRIEL, CALIFORNIA



SUCCESSOR TO THE MPN

FOR WATER ANALYSIS

Millipore® filters give direct, confirmed results in 16 hours with far less equipment and fewer man hours than fermentation tube methods.

APHA Standard Method
USPHS Approved

Complete technical information available from

Millipore

FILTER CORPORATION

BEDFORD, MASSACHUSETTS

the basis principles of flow ratio control.

Four common forms of flow ratio control are concisely discussed and illustrated by means of simple schematic drawings. Instrument and flowmeter requirements are provided.—Fischer & Porter Co.

Circle No. 1090 on Reader Service Card

Liquid Loader Catalog

A new 28-page Liquid Loader Catalog is now available. The catalog fully illustrates and describes the seven basic types of Liquid Loaders available. It also shows what type Liquid Loader to use and where, suggestions for better performance, loading valves available, swivel joints and miscellaneous fittings, flow charts, capacities, dimensions, prices and complete engineering and technical information.—OPW-Jordan Corp.

Circle No. 1091 on Reader Service Card

End-Suction Centrifugal Pumps

Four page Bulletin 117 PKG illustrates and describes this manufacturer's new "Packaged Line" of Type GP Close-Coupled End-Suction Centrifugal Pumps.

These pumps are designed for minimized effort in maintenance and inspection with complete disassembly without disturbing the suction or discharge piping. Vertical centerline discharge makes these pumps self-venting to eliminate vapor locks and provide smooth, running operation. Packaged in a variety of sizes for stock delivery, these pumps range in capacities up to 400 gpm and heads up to 150 ft.—Aurora Pump Div., The New York Air Brake Co.

Circle No. 1092 on Reader Service Card

Pumping Equipment

12-page condensed application guide catalog covers the complete range of pumping equipment offered by this manufacturer.

The line of pumps includes a type, size and capacity to meet practically every requirement—sizes to 152 in., capacities to 800,000 gpm, heads to 3000 psi, for many kinds of clear liquids and those containing solids in suspension.

To aid in selection, the Guide includes a chart which gives the basic

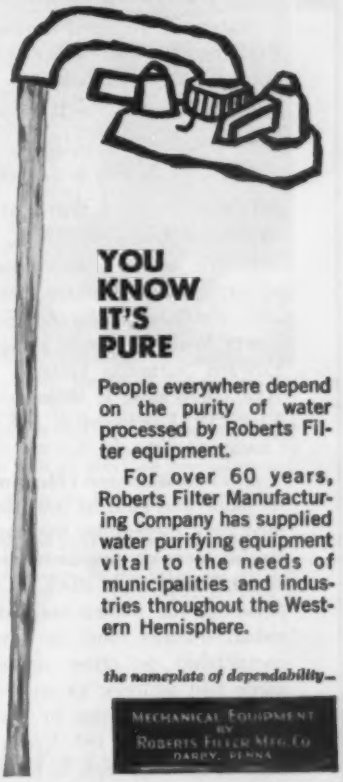
CONTINUED ON PAGE 126A

Rugged transistorized construction practically eliminates maintenance costs... extends battery life to a year or more. Pinpoint accuracy, greatest depth penetration make the M-scope first choice in the field! Only $189.50

Send for FREE catalog

Fisher RESEARCH LAB., INC.

Dept. WS-6, Palo Alto, Calif.



YOU KNOW IT'S PURE

People everywhere depend on the purity of water processed by Roberts Filter equipment.

For over 60 years, Roberts Filter Manufacturing Company has supplied water purifying equipment vital to the needs of municipalities and industries throughout the Western Hemisphere.

the nameplate of dependability—

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING COMPANY
COLUMBIA AVENUE, DARBY, PA.

New Literature

CONTINUED FROM PAGE 125A

data on the following types of pumps: End Suction, Split Case, Non-Clog, Biltogether, Peripheral, Turbine, Propeller, Sump, Coolant, Fire and Rotary.—Fairbanks, Morse & Co.

Circle No. 1093 on Reader Service Card

Primary Sewage Treatment Plant

8-page Catalog 300 describes the Spirahoff®, a primary settling and sludge digestion plant in a single structure or a component of a complete plant. Catalog contains technical data, specifications and drawings.—Yeomans Brothers Co.

Circle No. 1094 on Reader Service Card

Pump Drives Bulletin

20-page technical brochure illustrates and describes this manufacturer's various lines of pump motors and drives. Data presented will expedite the selection of the optimum motor or drive for each specific pump application.

The brochure is indexed so that motors and drives may be identified as to construction types (solid shaft, hollow shaft, submersible, horizontal, etc.); as to enclosure (weather protected, totally-enclosed, explosion-proof, etc.); as to thrust (high, medium, normal); and as to U. S. type designation.

Condensed specification data include ratings, dimensions, thrust capacities in pounds, speeds, frame sizes, ratios and selection charts (for gear drives), and electrical specification material.—U. S. Electrical Motors Inc.

Circle No. 1095 on Reader Service Card

Centrifugal Pumps

4-page Bulletin 3913 illustrates and describes this manufacturer's new, low-cost centrifugal pump line. It includes descriptions, photographs, performance tables and dimension prints for sizes 1 in. through 3 in.

The new end suction centrifugal pump employs double ball bearings and is equally suited for belt or direct motor drive. Capacity range is from 10 gpm to 300 gpm, and heads range to 150 ft.—The Deming Co.

Circle No. 1096 on Reader Service Card

Combination Pipe-Leak Locator

Brochure illustrates and describes this manufacturer's new LC-5 T "Dualtronic" which combines a Pipe Locator of great versatility with an extremely sensitive microphone and circuit for use in pinpointing water leaks. Additionally, through a very simple manipulation the instrument will readily detect valves, valve caps, manhole covers, etc.

Transistors are used throughout the transmitter and receiver, as are other important electronic advancements, to increase sensitivity and reliability.—The Goldak Co., Inc.

Circle No. 1097 on Reader Service Card

STATEMENT OF OWNERSHIP

Statement required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) showing the ownership, management and circulation of

Water & Sewage Works

published 13 times yearly at Pontiac, Illinois, for October, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Edward Scranton Gillette, 185 North Wabash Ave., Chicago 1, Illinois: Editor, Edward Scranton Gillette, 185 North Wabash Ave., Chicago 1, Illinois; Managing Editor, Virgil W. Langworthy, 185 North Wabash Ave., Chicago 1, Illinois.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Scranton Publishing Co., Inc., 185 North Wabash Ave., Chicago 1, Ill.; Edward S. Gillette, 185 North Wabash Ave., Chicago 1, Ill.; Claribel T. Gillette, 185 North Wabash Ave., Chicago 1, Ill.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 8,778.

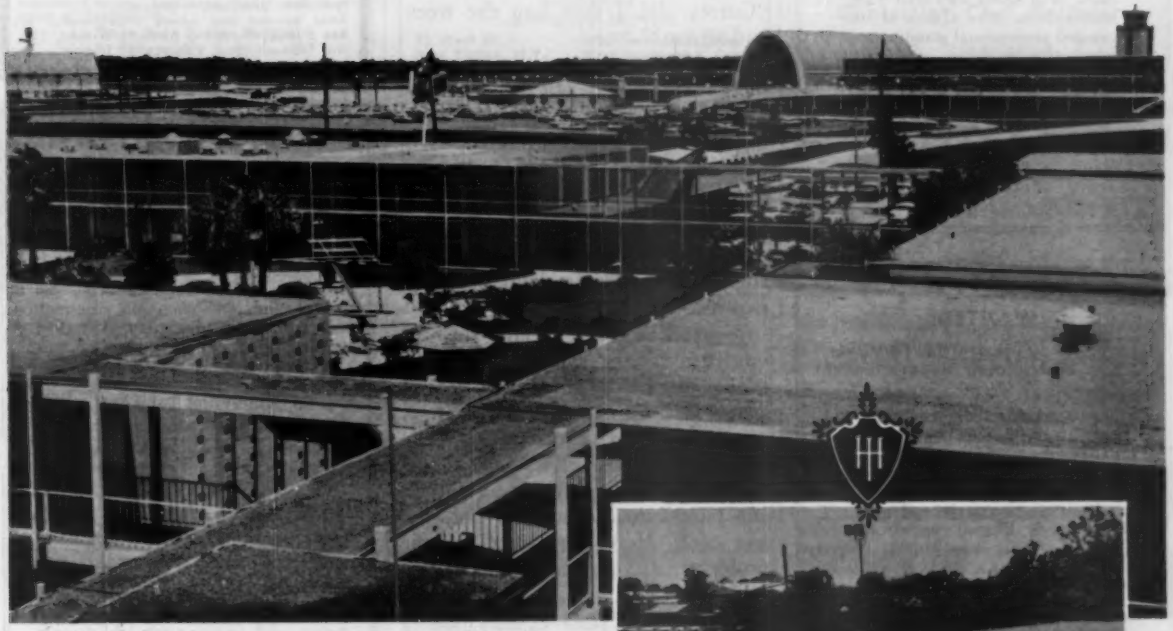
E. Scranton Gillette, Publisher

Sworn to and subscribed before me this 7th day of September, 1961. Helen Buford Hoppe, Notary Public. (My commission expires March 19, 1964.)

We're proud to count the beautiful Jet-Age **Hilton Inn**

ACROSS FROM INTERNATIONAL AIRPORT

NEW ORLEANS



among our **"OXIGEST"** *sewage treatment plant installations . . .*

S&L

The 310-unit Hilton Inn Motor Hotel at Kenner, Louisiana, is served by dual "Oxigest" sewage treatment plants, capable of handling 40,000 gallons of domestic sewage per day. The treatment facility was designed by Edward H. Sanford & Associates, Consulting Engineers, of New Orleans, La., and was installed over two years ago.

We are pleased to include the Hilton Inn in our growing list of factory-built treatment plant installations at motels, schools, factories and subdivisions . . . write to Department 20.

"We, in the Hilton organization, appreciate the responsibility Smith & Loveless has assumed in the operation of the Hilton Inn treatment facility. It is gratifying to know that your firm backs its equipment with such responsibility and service. Our engineers report that the treatment plant is performing in accordance with all specified guarantees and local and state health department requirements." . . . *C. N. Hilton, Jr., Vice President, Hilton Inns Inc.*

"Because of the unusual efforts your company has expended on this installation, and your continued interest in the satisfactory function and performance of the plant, we express our sincere appreciation to you." . . . *Edward H. Sanford & Associates.*

Smith & Loveless

ONE OF THE UNION TANK CAR COMPANIES

P. O. BOX 8884 / KANSAS CITY 15, MISSOURI / PLANT: LENEXA, KANSAS

(3838)

MANAGER of RESEARCH

Advanced degree in Sanitary or Chemical Engineering with 10 years' experience in water and waste treatment or related field. To direct R&D program of nationally-known, progressive company. Will select own staff (ultimately 15 to 20). A man of recognized professional standing and administrative ability is required, to originate and apply new methods and procedures to the development of new processes and equipment designs.

Send resume and salary requirements to **Box #1001,** *Water & Sewage Works, 185 No. Wabash Ave., Chicago, Illinois.*

WANTED:

Water Plant Superintendent
Water Distribution Superintendent

Mid-Western University City of 40,000 population is accepting applications of the above positions. The City has recently assumed operation of the Water Utilities and the position offers a real challenge for competent and experienced men. Salary open, liberal vacation, sick leave, etc. Apply box 10003. WATER & SEWAGE WORKS, 185 N. Wabash Ave., Chicago 1, Illinois.

CALIFORNIA'S
welcome to the world

Miramar
and NEW TOWER California's World-Famous Resort overlooking the Blue Pacific where Wilshire meets the sea. Twenty minutes from International Airport. 450 luxurious rooms and bungalows, all with television and radio. Complete convention facilities. Banquet rooms for up to 2,000, air-conditioned. Exciting new Venetian Room and Cantonese Room. Swimming pool Beautiful grounds and landscaped gardens. Rates from $8.

Across the U.S.A. and in HAWAII
MASSAGLIA
CREST OF GOOD LIVING
JOSEPH MASSAGLIA, JR., President

MASSAGLIA HOTELS
- SANTA MONICA, CALIF. Hotel Miramar
- SAN JOSE, CALIF. Hotel Sainte Claire
- GALLUP, N.M. Hotel El Rancho
- ALBUQUERQUE, Hotel Franciscan
- WASHINGTON, D.C. Hotel Raleigh
- HARTFORD, CONN. Hotel Bond
- PITTSBURGH, PA. Hotel Sherwyn
- CINCINNATI, O. Hotel Sinton
- HONOLULU Hotel Waikiki Biltmore

World-famed hotels
Teletype service—Family Plan

PARTIALLY ORIENTED . . .

CONTINUED FROM PAGE 404

"Now I intend to frighten you." *We could stand on our rights* means—"Take that. (bong!)" *You —— engineers* means—"Give me time to simmer down, I am enjoying this." *My Head office will . . .* means—"Watch out, I have a big stick up my sleeve." *Where has he got to?* means—"Curses, did I give him the weekend off too?"

On the other hand, perhaps this dictionary should not be advanced too far. I'd hate to see all this research work research away the civilities of civil engineering life; it might not be such fun.

KEEP 'EM ROLLING

CONTINUED FROM PAGE 405

engines, and increase your operating expenses.

Most of us are careful to keep our rig's cooling systems clean. We head for the shop when *over* heating crops up, but we are little aware of *under* heating problems.

A truck engine is designed to operate within a narrow range of coolant temperatures—not too hot, not too cool. Here are some of the problems if your engine runs too cold:

Oil dilution: Poor vaporization of the fuel-air mixture lets raw gasoline run down the cylinder walls and dilute your crankcase oil. The diluted oil can't give you proper lubrication, and this means more than normal wear.

Metal stresses: Metals expand with heat, and they are machined and fitted together with this expansion figured in. If the engine is not up to temperature, the metals will not expand sufficiently to fit with the fine tolerances needed. This means the engine parts are "sloppy" in their fit, which causes greater stresses, and greater wear patterns as they slosh around. Underheated parts also will tend to fail quicker than parts up to operating heat.

Sludge formation: A cold engine condenses moisture inside the crankcase. This moisture would normally be exhausted as hot gases. Now it combines with carbon, metal particles, dirt, etc., in the crankcase and forms sludge that lodges around piston rings, valves and other engine parts. Sludge robs you of power and hurts normal lubrication. Undercooling also means spark plug fouling.

CHEMICAL RESEARCH ENGINEER

Chemical Engineer, MS preferred, with 3-5 years experience, reporting to Manager of Research. To apply chemical engineering principles to the water and waste treatment field. Supervise and evaluate experimental work and prepare feasibility studies. New staff being recruited by nationally-known, progressive company.

Send resume and salary requirements to **Box #1002,** WATER & SEWAGE WORKS, 185 No. Wabash Ave., Chicago 1, Illinois.

WANTED

Superintendent of Primary Sewage Treatment Plants treating 25 MGD. Requirements—3 years in charge of primary sewage treatment plant with separate sludge digestion; age 25-40, salary $6000.00-$6400.00, position under Civil Service with liberal pension, vacation, insurance and sick leave benefits. Write for application form to J. W. Whisman, Engineer in Charge, City of Knoxville, Sewage Disposal System, P.O. Box 33, Knoxville, Tenn.

WANTED:

Sanitary Engineers for design work on water and sewage treatment plants and related facilities. Must have 5 to 10 years experience. Salary based on qualifications and experience. Mid-western location. Reply Box No. 10005, Water & Sewage Works, 185 No. Wabash Ave., Chicago, Illinois

POSITION OPEN TO REGISTERED ENGINEER; Design-Sanitary, in northern California. CE plus advanced study in sanitary, age to 50. Minimum of 8-10 years practicing experience in dealing with feasibility studies, consulting, engineering services, design and professional counsel to clients on water treatment, sewage and sewers. Also able to direct, layout work and supervise other employees. For a well established consultant—$10,000 to $12,000 per year. Contact Clair A. Hill & Associates, P.O. Box 558, Redding, Calif.

DIRECTOR OF PUBLIC WORKS WANTED

City of Platteville, Wisconsin; 7,000 population; 20 employees (exclusive of education and police departments); mayor and 8 councilmen. Must be registered civil engineer; experience necessary; salary open; can assume duties after Nov. 1, 1961. Send application, qualifications, experience record, and desired salary to L. C. Kindschi, City Clerk, Platteville, Wisconsin.

Consulting Engineers *IN WATER & SEWAGE WORKS*

ALBRIGHT & FRIEL INC.
Consulting Engineers
Water, Sewage, Industrial Wastes and Incineration Problems—City Planning, Highways, Bridges and Airports—Dams, Flood Control, Industrial Buildings—Investigations, Reports, Appraisals and Rates—Laboratory for Chemical & Bacteriological Analyses—Complete Service on Design and Supervision of Construction.
Three Penn Center Plaza
Philadelphia 2, Pa.

Bowe, Albertson & Associates
Engineers
Water and Sewage Works
Industrial Wastes
Refuse Disposal
Valuations
Laboratory Service
75 West St. New York 6, N.Y.
1000 Farmington Ave. West Hartford 7, Conn.

Capitol Engineering Corporation
Consulting Civil Engineers
Dillsburg, Pennsylvania, U.S.A.

Alvord, Burdick & Howson
Engineers
Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation
20 N. Wacker Drive. Chicago 6, Ill.

BOYLE ENGINEERING
Consulting Engineers
Water—Sewers—Streets
Structures—Surveys
Reports—Special Districts
331 Spurgeon Bldg. Santa Ana, Calif.
4525 Mission Gorge Pl. San Diego 20, Calif.

The Chester Engineers
Water Supply and Purification—Sewage and Industrial Waste Treatment—Power Plants—Incineration—Gas Systems—Valuations—Rates—Management—Laboratory—City Planning
601 Suisman Street
Pittsburgh 12, Penna.

JOHN J. BAFFA
Consulting Engineer
Water Supply and Treatment
Sewerage and Sewage Treatment
75 West Street New York 6, N. Y.

Brockway, Weber & Brockway
ENGINEERS INCORPORATED
Land Planning, Civil, Structural, Municipal and Electrical Engineering
Reports, Plans, Specifications & Supervision
HOME OFFICE—WEST PALM BEACH, FLA.

CHAS W. COLE & SON
Engineers and Architects
3600 E. Jefferson Blvd.
South Bend, Indiana
2112 W. Jefferson St.
Joliet, Illinois

MICHAEL BAKER, JR., INC.
Consulting Engineers, Planners & Surveyors
Airport, Highway & Bridge Design; Water & Sewerage Municipal Engineering; Photo Mapping City Planning, Urban Renewal & Redevelopment Soils Lab; Complete Survey Service
HOME OFFICE: ROCHESTER, PA.—Baker Bldg., P. O. Box 111
Jackson, Miss. Northview Drive P.O. Box 9987
Charleston, W. Va. 19 Dunbar St. P. O. Box 2148
Harrisburg, Pa. 2799 N. Fourth St. P.O. Box 790

Buck, Seifert and Jost
Consulting Engineers
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories
112 East 19th St. New York

CONSOER, TOWNSEND & ASSOCIATES
—CONSULTING ENGINEERS—
Sewage treatment, sewers, storm drainage, flood control—Water supply and treatment—Highway and bridges—Airports—Urban renewal—Electric and gas transmission lines—Rate studies, surveys and valuations—Industrial and institutional buildings.
360 East Grand Avenue, Chicago 11, Illinois

Betz Laboratories, Inc.
CONSULTING ENGINEERS
INDUSTRIAL WASTE
INDUSTRIAL WATER
ANALYSIS DESIGN
INVESTIGATIONS OPERATION
Gillingham & Worth Sts.
Philadelphia 24, Pa.

BURGESS & NIPLE
Civil and Sanitary Engineers
Water Supply and Purification
Sewerage and Sewage Treatment
Appraisals, Reports, Valuations
2015 West Fifth Avenue
Columbus 12, Ohio

MR. CONSULTING ENGINEER
Are you interested in both
WATER & SEWAGE
If so there is no better place for your professional card than in this dual interest magazine.
Water & Sewage Works

BLACK & VEATCH
Consulting Engineers
Sewage—Waste Disposal—Water
Electricity—Industry
Reports, Design, Supervision of Construction, Investigations, Valuations and Rates
1500 Meadow Lake Parkway
Kansas City 14, Missouri

BURNS & McDONNELL
Engineers—Architects—Consultants
4800 E. 63rd St. Trafficway
Kansas City 41, Missouri

CRAWFORD, MURPHY & TILLY
Consulting Engineers
Water and Sewerage Systems
Sewage and Wastes Treatment
Storm Drainage — Flood Control
Impounding Reservoirs
Pollution Control Studies
Surveys, Reports, Design, Supervision
Phone: 217-528-5619
755 So. Grand West, SPRINGFIELD, ILL.

CLINTON BOGERT ENGINEERS
CONSULTANTS
Ivan L. Bogert Robert A. Lincoln
Charles A. Manganaro William Martin
Water & Sewage Works • Incinerators
Drainage • Flood Control
Highway and Bridges • Airfields
146 East 32nd Street, New York 16, N. Y.

Camp, Dresser & McKee
Consulting Engineers
14 Tremont Street, Boston 8, Mass.
Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

ENGINEER ASSOCIATES
Consulting Engineers
Sewage Disposal Systems, Water Works Design, Airports, Highways and Bridges, City Planning & Engineering for Building Design
312 N. W. Eighth St.
Evansville, Indiana

Additional Engineers Cards on Next Page

MR. CONSULTING ENGINEER

Are you interested in both

WATER & SEWAGE

If so there is no better place for your professional card than in this dual interest magazine.

Water & Sewage Works

HAVENS AND EMERSON

A. A. Burger — F. S. Palocsay
J. W. Avery — G. H. Abplanalp
E. S. Ordway — S. H. Sutton
A. M. Mock
Frank C. Telles, Consultant
Consulting Engineers
Water, Sewerage, Garbage, Industrial Wastes, Valuation, Laboratories

Leader Bldg., Cleveland 14, O. — Woolworth Bldg., New York 7, N. Y.

METCALF & EDDY

ENGINEERS

Investigations • Reports
Planning • Siting • Design
Supervision of Construction & Operation
Valuations • Rates • Research • Management

1300 Statler Building, Boston, Mass.

FAY, SPOFFORD & THORNDIKE, INC.

Engineers

Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment
Airports — Bridges — Express Highways
Port and Terminal Works — Industrial Plants
Investigations, Reports, Designs, Valuations
Supervision of Construction

11 BEACON STREET, BOSTON 8, MASS.

HAZEN AND SAWYER

ENGINEERS

Richard Hazen — Alfred W. Sawyer
H. E. Hudson, Jr.

Water and Sewage Works
Industrial Waste Disposal
Drainage and Flood Control

360 Lexington Ave., New York 17, N. Y.

O'BRIEN & GERE

Consulting Engineers

Water Supply, Treatment and Distribution
Sewerage and Sewage Treatment
Industrial Waste Treatment—Flood Control and Drainage—Rate Studies

400 East Genesee Street — Syracuse 2, N. Y.

FINKBEINER, PETTIS & STROUT

CONSULTING ENGINEERS

Water Supply, Water Treatment,
Sewerage, Sewage Treatment,
Bridges, Highways & Expressways

2130 Madison Avenue — Toledo 2, Ohio

Henningson, Durham & Richardson

Engineers • Architects • Planners • Consultants
ENGINEERING SINCE 1917

Reports, Planning, Appraisals, Architectural Design, Highways, Bridges, Streets, Airports, Sewerage, Waterworks, Power Plants, Electrical Systems, Natural Gas Systems, Industrial Design

OMAHA — COLORADO SPRINGS — PHOENIX

PARSONS, BRINCKERHOFF QUADE & DOUGLAS

Civil and Sanitary Engineers

Water, Sewage, Drainage and Industrial Waste Problems.

Structures—Power—Transportation

165 Broadway — New York 6, N. Y.

FULTON & CRAMER

Consulting Engineers

General Municipal Engineering Service Since 1909

Reports
Valuations
Rate Studies
Design
Construction Supervision

922 Trust Building — Lincoln, Nebraska

The Jennings-Lawrence Co.

Civil & Municipal Engineers

Consultants

Water Supply, Treatment & Distribution
Sewers & Sewage Treatment
Reports—Design—Construction

1392 King Ave. — Columbus 12, Ohio

MALCOLM PIRNIE ENGINEERS

Malcolm Pirnie — Carl A. Armandor
Ernest W. Whitlock — Malcolm Pirnie, Jr.
Robert D. Mitchell — Alfred C. Leonard

MUNICIPAL AND INDUSTRIAL
Water Supply—Water Treatment
Sewage and Waste Treatment
Drainage—Rates—Refuse Disposal

25 West 43rd St., New York 36, N. Y.
3013 Horatio Street, Tampa 9, Florida

GANNETT FLEMING CORDDRY & CARPENTER, Inc.

ENGINEERS

Dams, Water Works, Sewage, Industrial Wastes & Garbage Disposal, Highways, Bridges & Airports — Traffic & Parking Appraisals, Investigations & Reports

HARRISBURG, PA.
PITTSBURGH, PA. — PHILADELPHIA, PA.
DAYTONA BEACH, FLA.

Jones, Henry & Williams

Consulting Sanitary Engineers

Water Works
Sewerage & Treatment
Waste Disposal

2000 West Central Ave. — Toledo 8, Ohio

THE PITOMETER ASSOCIATES, INC.

Engineers

Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurements & Special Hydraulic Investigations

New York. — 50 Church Street

GILBERT ASSOCIATES, INC.

Engineers and Consultants

Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
Investigations and Reports

New York — Reading, Pa. — Washington
Houston — Philadelphia

KENNEDY ENGINEERS

SANITARY ENGINEERING

LOS ANGELES—SALT LAKE CITY
TACOMA—SAN FRANCISCO

LEE T. PURCELL

Consulting Engineers

Water Supply & Purification; Sewerage & Sewage Disposal; Industrial Wastes; Investigations & Reports; Design; Supervision of Construction & Operation
Analytical Laboratories

36 De Grasse Street — Paterson 1, N. J.

GREELEY AND HANSEN

Engineers

Samuel A. Greeley — Paul Hansen (1920-1944)
Paul E. Langdon — Kenneth V. Hill
Thomas M. Niles — Samuel M. Clarke

Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal

14 East Jackson Blvd., Chicago 4

Morris Knowles, Inc.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal Valuations, Laboratory, City Planning

1312 Park Building, Pittsburgh, Pa.

Rader and Associates

Engineers and Architects

Water Works, Sewers, Refuse Disposal and Other Public Works Engineering Reports, Investigations, Consultations, Plans, Specifications and Supervision of Construction Work

100 Biscayne Blvd. South, Miami 32, Fla.

Haskins, Sharp & Ordelheide

Consulting Engineers

Water—Sewage & Industrial Wastes—Hydraulics

Reports, Design, Supervision of Construction
Appraisals, Valuations, Rate Studies

1809 Baltimore Ave. — Kansas City 5, Mo.

LOZIER CONSULTANTS, INC.

Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal

Engineers

10 Gibbs Street — Rochester 4, N. Y.

ROY EDWIN RAMSEIER AND ASSOCIATES

Sanitary and Hydraulic Engineers
Water Supply, Treatment, Distribution
Sewerage and Sewage Treatment
Chemical and Bacteriological Laboratories

1539 Solano Avenue, Berkeley 7, California

Additional Engineers Cards on Next Page

ROBERT AND COMPANY
ASSOCIATES
MUNICIPAL ENGINEERING DIVISION
ATLANTA

STANLEY ENGINEERING COMPANY
Consulting Engineers
Hershey Building, Muscatine, Iowa — 208 S. LaSalle St., Chicago 4, Ill.
Hanna Building, Cleveland 15, Ohio

Leonard S. Wegman Co.
Consulting Engineers
Refuse Disposal, Water Supply, Sewage Collection & Treatment, Highways, Bridges, Special Structures, Shore Erosion & Waterfront Works
238 East 45th Street New York 17, N. Y.

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.
309 East 149th Street
New York 55, N. Y.

Alden E. Stilson & Associates
Limited
Consulting Engineers
Water Supply—Sewage—Waste Disposal
Bridges—Highways—Industrial Buildings
Studies—Surveys—Reports
75 Public Square, Cleveland 13, Ohio
245 North High Street, Columbus 15, Ohio

Weston & Sampson
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service Supervision, Valuations
14 Beacon St. — Boston, Mass.

Benjamin L. Smith & Associates
Engineers
Investigations—Reports
Designs—Supervision—Valuations
Municipal Engineering and Public Utilities
11 North Pearl Street
Albany 7, New York

SWINDELL-DRESSLER CORP.
Consulting Engineers
Industrial Plants—Waterworks
Sewer Systems—Highways—Dams
Bridges—Surveys—Reports
Design and Construction Supervision
Box 1888 • Pittsburgh 30, Pa.

Whitman & Howard
Engineers (Est. 1869)
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

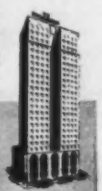
John R. Snell
ENGINEERS
Inc. 221 N. Cedar ■ Lansing, Mich. ■ IV 4-9493
Water Purification ■ Water Supply ■ Sewerage Systems ■ Sewage Treatment ■ Refuse Collection ■ Composting ■ Incineration ■ Urban Planning ■ Industrial Waste ■ Bridges and Streets ■ Soils and Foundations ■ Research and Development

TURNER & COLLIE
Consulting Engineers, Inc.
3100 Eastside St.
P. O. Box 13089
HOUSTON 19, TEXAS

WHITMAN, REQUARDT & ASSOCIATES
Engineers—Consultants
Civil—Sanitary—Structural—Mechanical—Electrical
Reports, Plans, Supervision, Appraisals
1304 St. Paul Street
Baltimore 2, Maryland

Four Fine Facilities in PITTSBURGH

ALLEGHENY MOTOR INN
Opposite Greater Pittsburgh Airport. 60 air-conditioned rooms, tile bath, TV, radio, phone. Superb restaurant and cocktail lounge. Year-round swimming pool. Courtesy car to and from airport. AMherst 4-7790



HOTEL PITTSBURGHER
In the heart of the Golden Triangle. 400 outside rooms, bath, radio, TV, air-conditioning. General Forbes Lounge & Dining Room. ATlantic 1-6970

JACKTOWN MOTOR HOTEL
1 mile west of Irwin Interchange on Route 30. 60 air-conditioned rooms with TV, telephone, combination tile baths. Excellent dining room and facilities for group parties. UNderhill 3-2100

HOTEL PITTSBURGHER MOTEL
Opposite Greater Pittsburgh Airport. 56 air-conditioned rooms, tile bath, radio, TV, private phone. Courtesy car to and from airport. AMherst 4-5152

KNOTT HOTELS
Joseph F. Duddy, Gen. Manager

*Teletype Service. Telephone any Knott Hotel. All Knott Hotels and offices in U.S. connected by teletype.

Route 30, Lincoln Highway, Shortest Route to Pittsburgh

NEW YORK CITY
for important business and leisurely pleasure

TIMES SQUARE
for 'round-the-clock entertainment and city-wide convenience

HOTEL WOODSTOCK
ALBERT FERNANDEZ, General Manager
for top-flight accommodations & service—Cocktail Lounge & Restaurant

127 WEST 43 ST.
for full color brochure and full rate information

JUDSON 2-5000
for immediate confirmation of your Woodstock reservation

It's NEW for HEAVY-DUTY SEWAGE USES

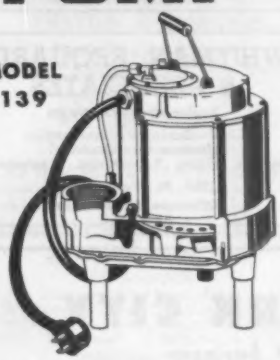
KENCO®

HIGH CAPACITY 8600 GPH at LOW HEAD 5 ft. Head

6800 GPH at 10-ft.

PUMP

MODEL 139



- Completely Submersible
- Rugged Cast-Bronze Construction
- Extra-Deep 2-Vane NON-CLOG Impeller
- 2" NPT Discharge
- Extra Powerful Pumping Action
- Shreds sewage and other solids for dependable non-clog performance
- Leg supports—threaded to use any standard ½" pipe for readily adjustable stand

See Your Wholesaler

A-3003A

KENCO PUMP

Division of The American Crucible Products Co.

1305 Oberlin Avenue • Lorain, Ohio

Advertisers Index

A

*Allis-Chalmers 12A-13A-15A-31A
*American Cast Iron Pipe Co. 19A
*Aurora Pump Div. (N. Y. Air Brake Co.) 48A

B

*B-I-F Industries, Inc. 41A
Buffalo Meter Co. Inc. 21A
*Builders Providence, Inc. 41A

C

Carborundum Co. 44A
Carus Chemical Co., Inc. 8A-9A
Cast Iron Pipe Research Ass'n. 22A-23A
Centriline Corp. 118A
*Chain Belt Co. 107A
*Chicago Bridge & Iron Co. ..... Inside Front Cover
*Chicago Pump Co. 39A
Climax Eng. Mfg. Co., Div. Waukesha Motor Co. 38A
*Clow & Sons, Jas. B. 10A-11A
Consulting Engineers 129A-130A-131A

D

Darley & Co., W. S. 124A
Darling Valve Co. 55A
Dean & Co., Payne 116A
Detectron Div., Tinker & Rason 125A
*DeZurik Co. 46A
Dow Industrial Service 32A
*Dorr-Oliver, Inc. ..... Inside Back Cover

E

Enterprise Engine Div. 56A

F

Fairbanks, & Morse Co., Beloit Div. 40A
Fairbanks, Morse & Co., Hydraulic Div. 105A
Fischer Research Co. 125A
Foxboro Co. 24A-25A
Fuller Co. 122A

G

Glenfield & Kennedy, Inc. 43A
*Golden-Anderson Valve & Spec. Co. 114A

H

Hersey Sparling Meter Co. 47A
Hydro Silica Corp. 50A

I

Indiana Gunite & Constr. Co., Inc. 124A
Industrial Chemical Sales 27A
Iowa Valve Co. 53A

J

*Jeffrey Mfg. Co., The 30A
Johns-Manville 109A

K

Keasbey & Mattison 35A-36A
Kenco Pump Div. Amer. Crucible Products Co. 132A
*Komline Sanderson Engr. Co. 57A

L

Layne & Bowler Pump Co. 18A
Leupold & Stevens Insrtuments, Inc. 119A
LimiTorque 52A

M

*M & H Valve & Fittings Co. 121A
Millipore Filter Corp. 125A
Mueller Company 16A-17A-37A

N

National Clay Pipe Mfrs'. Ass'n. 120A
*Neptune Meter Company 58A
*Nichols Engr. & Research Corp. 117A

O

Olin-Mathieson Chemical Corp. (Mathieson Chemicals) 4A
Olin-Mathieson Chemicals Corp. (Organic Chemicals) 4A

P

*Pacific Flush Tank Company 1A-2A
Pacific Pump Co. 115A
Philadelphia Chemical Co. 51A
Philadelphia Gear Corp. 52A
*Philadelphia Quartz Co. 123A
*Phipps Bird, Inc. 124A
Pittsburgh Chemical Co. 51A
*Pratt Co., Henry 45A

R

*Roberts Filter Co. 125A
Roots-Connersville Dresser Industries, Inc. 49A

S

Simplex Valve & Meter Co. (Div. Pfaudler Permutit, Inc.) 100A
Smith Mfg. Co., A. P. 42A
Smith-Blair 113A
Smith & Loveless 127A
Speelman Elevated Tank Co. 124A
Synchro-Start Products, Inc. 50A
System Analyzer 122A
Synchro-Start Products, Inc. 50A

T

Templeton, Kenly & Co. 123A

U

U. S. Electrical Motors, Inc. ..... Back Cover
*U. S. Pipe & Fdry. Co. 28A-29A

V

Victaulic Co. of America 6A

W

*Walker Process Equip. Co. 103A
*Waukesha Motor Co. 34A-54A-103A
W K M Div. A C F Industries 33A
Weil Pump Co. 111A
Wiley & Sons, Inc., John 120A
Wood Co., R. D. 99A

Y

*Yeoman's Bros. Co. 101A

*Advertisers represented in the 1960 Reference Number with Catalog specifications copy. Please refer to that issue for additional information concerning their product or equipment.

USE THIS **POST PAID** CARD
TO ENTER NEW SUBSCRIPTIONS

for

WATER & SEWAGE WORKS

. . . The ONLY publication devoted exclusively (and thoroughly) to the treatment of water for industrial uses AND the treatment, utilization and disposal of industrial wastes. Bi-monthly.

and

INDUSTRIAL WATER AND WASTES

. . . the leading monthly publication in its field for Superintendents, Operators and Engineers.

(see other side)

USE THIS **POST PAID** CARD
FOR READER SERVICE REQUESTS

The numbers on the card correspond to the numbers assigned to the various catalogs and other literature described in the "New Equipment" and "New Literature" sections of this issue, which are available FREE OF CHARGE.

Simply detach the card along the perforated lines, circle the items you wish to receive, fill in your name, address etc. and mail this card for our prompt attention.

(see other side)

PLEASE ENTER MY SUBSCRIPTION(S) AS INDICATED

☐ **WATER & SEWAGE WORKS, including the BIG ANNUAL REFERENCE NUMBER, for.....year(s).**

Three Years—$10.00 Two Years—$7.50 One Year—$5.00

(Add $1.50 per year for countries other than the U. S. A. and Canada)

Please check your principal activity:

☐ Sewage Only ☐ Water Only ☐ Water and Sewage

☐ **INDUSTRIAL WATER AND WASTES, including the Annual Technical Review, One Year—$3.00.**

(Add $1.50 per year for countries other than the U. S. A. and Canada)

Please state products manufactured or processed, etc.:

Name _____

Title or Position _____

Department or Firm Name _____

Address _____

City _____ Zn ___ State _____

READER SERVICE CARD

OCTOBER 1961

Circle the items on which information is desired. Requests will be received until December 31, 1961.

1001 1002 1003 1004 1005 1006 1007 1008 1009 1010
1011 1012 1013 1014 1015 1016 1017 1018 1019 1020
1021 1022 1023 1024 1025 1026 1927 1028 1029 1030
1031 1032 1033 1034 1035 1036 1037 1038 1039 1040
1041 1042 1043 1044 1045 1046 1047 1048 1049 1050
1051 1052 1053 1054 1055 1056 1057 1058 1059 1060
1061 1062 1063 1064 1065 1066 1067 1068 1069 1070
1071 1072 1073 1074 1075 1076 1077 1078 1079 1080
1081 1082 1083 1084 1085 1086 1087 1088 1089 1090
1091 1092 1093 1094 1095 1096 1097 1098 1099

If You Wish to Receive Further Information on Products Advertised or Referred to in the Articles of This Issue—List the Page and Item Below.

_____

_____

_____

Your Name _____

Title _____

Company or Dept. _____

Address _____

_____

USE THIS **POST PAID** CARD
TO ENTER NEW SUBSCRIPTIONS

for

WATER & SEWAGE WORKS

. . . The ONLY publication devoted exclusively (and thoroughly) to the treatment of water for industrial uses AND the treatment, utilization and disposal of industrial wastes. Bi-monthly.

and

INDUSTRIAL WATER AND WASTES

. . . the leading monthly publication in its field for Superintendents, Operators and Engineers.

(see other side)

USE THIS **POST PAID** CARD
FOR READER SERVICE REQUESTS

The numbers on the card correspond to the numbers assigned to the various catalogs and other literature described in the "New Equipment" and "New Literature" sections of this issue, which are available FREE OF CHARGE.

Simply detach the card along the perforated lines, circle the items you wish to receive, fill in your name, address etc. and mail this card for our prompt attention.

(see other side)

Postage Will Be Paid by Addressee

BUSINESS REPLY MAIL
First Class Permit No. 43608, Sec. 34.9, P.L.&R., Chicago, Ill.

WATER & SEWAGE WORKS
185 NORTH WABASH AVENUE
CHICAGO 1, ILLINOIS

No Postage Stamp Necessary If Mailed in the United States

Postage Will Be Paid by Addressee

BUSINESS REPLY MAIL
First Class Permit No. 43608, Sec. 34.9, P.L.&R., Chicago, Ill.

WATER & SEWAGE WORKS
185 NORTH WABASH AVENUE
CHICAGO 1, ILLINOIS

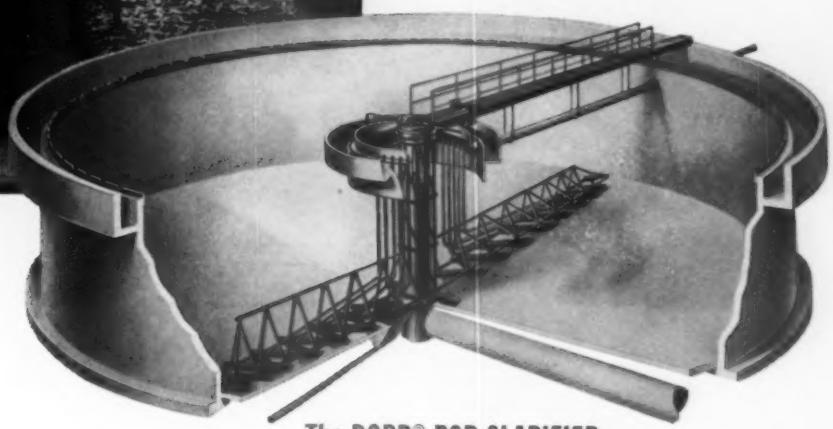
No Postage Stamp Necessary If Mailed in the United States

Here's a
DORR-OLIVER PROCESS TEAM

for efficient

ACTIVATED SLUDGE PLANT OPERATION

The Dorr-Oliver®
INKA AERATION SYSTEM



The DORR® RSR CLARIFIER

Key requirements for efficient utilization of the activated sludge process are an effective aeration system and continuous, controlled removal of sludge from secondary clarifiers. You get both in the combination of the new Dorr-Oliver INKA Aeration System and the Dorr RSR Clarifier.

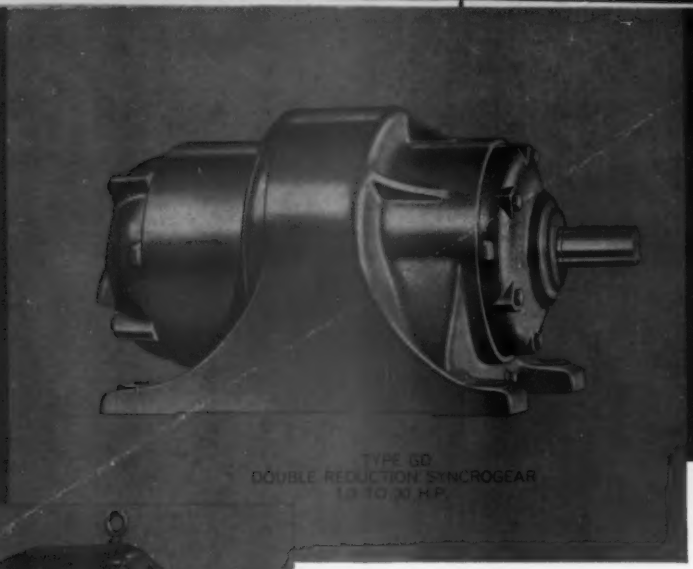
The D-O INKA System offers an entirely new approach to activated sludge aeration. Large volumes of low pressure air, supplied by low cost ventilating-type fans, provide for optimum mixing conditions and high oxygen absorption. Operating costs are exceptionally low.

With the Dorr RSR Clarifier, sludge removal is rapidly and continuously handled by rotating uptake pipes. Quality and quantity of sludge removed can be visually observed and easily controlled. Problems of excessive sludge detention in the final clarifier are eliminated, due to the rapid and complete removal of the biologically active sludge.

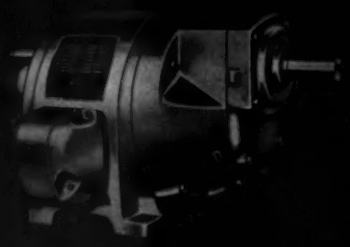
Together, the D-O INKA System and the RSR Clarifier offer an economical, highly efficient processing team. For more information, write Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER

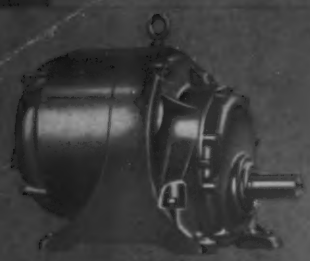
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT



TYPE GD
DOUBLE REDUCTION SYNCROGEAR
1/3 TO 30 H.P.



TYPE GH
SINGLE REDUCTION SYNCROGEAR
1/3 TO 30 H.P.

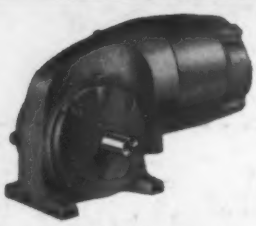


TYPE GR
SINGLE REDUCTION SYNCROGEAR
1/3 TO 30 H.P.

whatever you need in geared power... whatever the speed...whatever the horsepower...specify

U.S. Syncrogear...now with gears honed to super finish!

Again U.S. introduces a new first in gearmotor design: Gears *honed to super finish* for quiet, smooth running and longer life. A long succession of Syncrogear innovations by U.S. during the last 25 years have been widely adopted. **Through-hardening** of gears... the **solid-shank pinion**... the sturdy **"pyramidal" base... micro-shaving** of gears... solid cast **one-piece case**..."crowned" helical gear teeth of **elliptoidal design**... all these add years of trouble-free operation to Syncrogear life. To assure precision, U.S. makes its own gears. For more information on U.S. Syncrogear features, send for free color brochures: Syncrogear Bulletin No. F-1880, Right-Angle Worm-Gear Syncrogear Bulletin No. F-1650, or Shaftmount Syncrogear Bulletin No. F-1994.

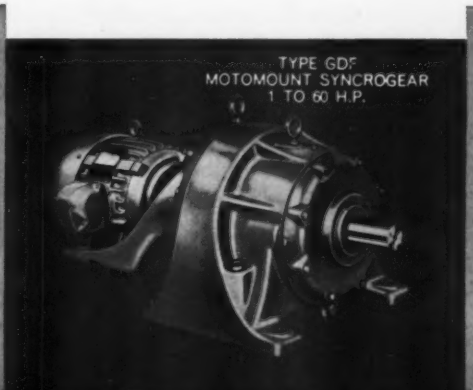


TYPE GW
RIGHT-ANGLE, WORM-GEAR
SYNCROGEAR
1/3 TO 2 H.P.

TYPE GDV
VERTICAL SYNCROGEAR
3 TO 30 H.P.

U.S. ELECTRICAL MOTORS INC.
P.O. Box 2058 • Los Angeles 54, California, or Milford, Connecticut

TYPE GM
TRIPLE REDUCTION SYNCROGEAR
1 TO 10 H.P.



TYPE GDF
MOTOMOUNT SYNCROGEAR
1 TO 60 H.P.

TYPE GC
SHAFTMOUNT SYNCROGEAR
1/4 TO 40 H.P.